DOCUMENT RESUME

ED 273 840 CE 045 082

AUTHOR	Lawson, Fred
TITLE	Quality Control. Supervising. Technical Aspects of Supervision. The Choice Series #35. A Self Learning Opportunity.
INSTITUTION	Northern Regional Management Centre, Washington (England).
SPONS AGENCY	Manpower Services Commission, London (England).
REPORT NO	ISBN-0-948023-71-6
PUB DATE	85
NOTE	85p.; For related documents, see ED 266 310-312, ED 268 236-263, ED 270 592-593, ED 271 586-590, and CE 045 083-084.
AVAILABLE FROM	Northern Regional Management Centre, Derwent House, Washington Town Centre, Washington, Tyne & Wear, England NE38 7ST ($15.00 plus postage; 15% discount on 50, 25% on 100; includes audiotape).
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Adult Education; Behavioral Objectives; Check Lists; Data Analysis; Data Collection; Distance Education; Learning Activities; *Operations Research; Postsecondary Education; *Quality Control; *Statistical Analysis; *Statistical Data; *Supervisory Methods; *Supervisory Training

ABSTRACT

This student guide is intended to assist persons employed as supervisors in improving their knowledge and skills in the area of quality control. Discussed in the first three sections are the following topics: quality and control (quality, measuring and achieving quality, controlling resources, and quality consciousness); quality control and statistics (means, ranges, graphs and histograms, and probability distributions); control data and control action (sampling procedures, mean and range control, control action, and acceptance sampling). Each of these sections contains an introduction, sections of instructional text that are interspersed with reinforcing learning activities, and a section summary. The fourth part of the guide includes a series of performance checks (an end check, a tutor check, and a work-based project). A unit review, which also includes a description of related extension courses and resources, concludes the guide. (MN)

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ED273840

An Open Tech Project

SUPERVISING

TECHNICAL ASPECTS OF SUPERVISION

35: Quality Control

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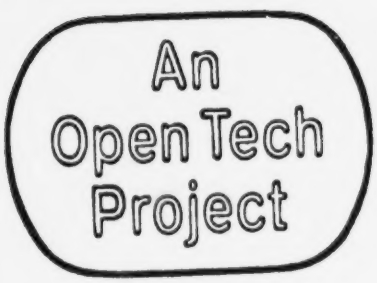
35: QUALITY CONTROL

Fred Lawson



The CHOICE programme is an Open Tech sponsored project managed by the Northern Regional Management Centre in conjunction with the Northern Consortium of Colleges and the National Examinations Board for Supervisory Studies.

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ISBN 0 948023 71 6
First published in the U K - 1985

Northern Regional Management Centre
Derwent House, Washington Town Centre
Washington, Tyne & Wear NE38 7ST

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Fred Lawson
Quality Control (Number 35 in the CHOICE SERIES of learning units)

Series Editor: Harry V Pardue
Northern Regional Management Centre.

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WORKING GUIDE TO THIS UNIT IN YOUR DEVELOPMENT PROGRAMME

This Unit is now your personal property - it's not for handing back to your training officer or to a tutor. It is your working book.

The Contents will increase in value to you each time you write on one of its pages. This is a working text for your personal notes - without notes its value is limited.

Qualifications forget about certificates and diplomas - you don't need them for this programme. What you do need is the wish:-

* to do your job better
* for personal development

Your study time is really up to you - we guess you will need about 8 hours in total. But it's your time - spend as long as you like.

How am I doing? you can judge for yourself by checking out how well you cope with the tasks we call Activities and Self Checks which occur throughout the unit. You can also get the Tutor Check and/or the Work Based Project to your tutor for an unbiased view of your progress.

Work Pace it's really up to you and depends on your interest. However, if you do well on the Activities and Self Checks, you could afford to speed up a little. Of course, if you don't do as well as you expect then you could slow down a little or flick back into the unit for a quick review of the more difficult ideas.

When in doubt - ask or seek help from:

* your family and friends
* colleagues at work
* your company training staff
* other open learners
* your tutor, by phone, by a visit to your support centre or by dropping your tutor a line through the post.

Don't worry if what you learn doesn't seem to be of use to you now, remember that times change - it may be useful one day. Anyway, just knowing more improves personal confidence.

So now make a start:-

35: QUALITY CONTROL by Fred Lawson

ABOUT THIS UNIT

Whenever we buy something either at work or in our private lives, we expect it to be of good quality. If it's not, then we may complain, ask for our money back or quietly decide not to deal with that supplier again. Whatever the decision, it will harm the supplier. Quality Control, well set up and well conducted, makes sure that things like this won't happen.

However, Quality Control is rather like safety, it's everyone's business - if poor quality reduces sales then the company and all who work there are the sufferers. Quality Control is not something that can properly be done as the final check before the customer buys. It would be sensible to check the car engine before it is fixed into the car, rather than afterwards.

Quality Control, as we will see, is a total process concerned with every aspect of any business and is more concerned with 'prevention' than it is with 'cure'. Your responsibility is to see that the work you are supervising is always of the proper quality, and that those who work with you are what we shall call "quality conscious".

IN THIS UNIT WE WILL:

* identify quality, control and inspection
* examine ways of assuring quality in all aspects of the job
* examine techniques which will help you monitor quality
* show how the information collected can help you to make sound decisions

AUDIO TAPE Side 1

Before you continue through the unit, you should listen to side 1 of the audio tape that accompanies the unit. You will find it useful if you refer to the unit objectives shown below whilst you listen to the tape. You may wish to make the objectives clearer to yourself by making a note or two on the page as you listen.

OBJECTIVES

When you have worked through this unit you will be BETTER ABLE to:

* define quality control and identify ways to assure quality in all aspects of the job
* create 'quality consciousness' in your workteam
* use quality control techniques to monitor the quality of what is produced in your work place
* use quality control information to make sound decisions.

PART A QUALITY AND CONTROL

1 Introduction

We're all interested in quality, particularly if we're the customer and we're paying.

Let's start by defining what we mean by 'quality'.

2 Quality

ACTIVITY 1
Time guide
3 mins

Suppose you are going to buy a fairly expensive piece of household equipment - a washing machine perhaps.

Jot down four features which would influence your choice of machine.

* _____
* _____
* _____
* _____

You could well have thought of dozens of things. Probably among the points you would take into consideration would be:

* size
* shape
* operating features (eg perhaps you only want a washing machine which will wash at low water temperatures)
* colour
* actual appearance (eg artistic design)
* delivery (eg can you have the machine when you want it?)
* price (eg how does it compare with other similar models in other shops?)

Let's have a closer look at this list of features. Although they all refer to the washing machine, there are some important differences worth noting. For instance the "actual appearance" of the machine is a different aspect to "operating features". Perhaps we could say that these features have a different "value" - "actual appearance" could be an artistic or "esteem" value and "operating features" a utility or "use" value.

We'll use these two values - use and esteem - to develop our ideas about quality and value.

ACTIVITY 2
Time guide
3 mins

Complete this table by noting, in the appropriate column, the features we listed in Activity 1. If you have listed some additional features then include them here:

USE VALUE (ie the usefulness of the product)	ESTEEM VALUE (ie other features we are willing to pay for)
*	*
*	*
*	
*	

A completed table could look like this:

USE VALUE	ESTEEM VALUE
* size	* colour
* shape	* actual appearance
* operating features	
* delivery	

Price had been excluded as it is neither use nor esteem - it is often referred to as Exchange value.

It seems clear from our table that, as customers, we are willing to pay for "use value" and for "esteem value". It's also clear that building in both these values will cost the manufacturer money - so as far as the manufacturer is concerned the washing machine has a cost value. If the difference between cost value and exchange value is large enough the manufacturer will make a profit.

When we deal with product (or service) quality we are concerned with all four values:

Use Value Esteem Value	because these encourage the customer to buy
Cost Value Exchange Value	because these determine the income to the manufacturer (or provider of the service)

It's important we keep in mind that quality has two important and related impacts

if QUALITY IS TOO LOW then customers will not buy or if they do, they will be dissatisfied

if QUALITY IS TOO HIGH then providers will not make the best profit.

However we must say something about the level of quality to aim at which lies between these extremes of "too low" and "too high". We cannot be precise but we can at least accept that quality must be at a level where the customer will buy and be satisfied with the purchase. Let's say this in a shorthand way so we can bear it in mind whenever we think, hear and speak of Quality:

QUALITY = FITNESS FOR THE CUSTOMER'S PURPOSE

ACTIVITY 3
Time guide
2 mins

Suppose whatever we want to buy doesn't meet our conditions of product requirement, price and delivery.

How are we likely to react?

Jot down two things which, as disappointed customers, we might do.

* _____

* _____

I think one thing we're likely to do is complain - either to the supplier or to friends and colleagues and, perhaps, put them off buying from the same supplier.

The other thing is that we're unlikely to buy that company's products or go to that shop in future - we'll find another supplier.

Disappointed business customers react in exactly the same way. A company's bad reputation with one customer can quickly spread to other customers and can seriously damage sales.

for money, the customer may not complain much, he may simply go away.

On the other hand, a high quality product and a high quality service can persuade customers to come back time after time and is one of the most effective ways of promoting the company's business.

QUALITY IS THE SILENT SALESMAN

So there are three areas where we have to ensure quality as far as the customer is concerned.

SELF CHECK 1
Time guide
3 mins

Complete the blanks in the following statement.

The three broad areas with which the customer will be concerned are:

* _____
* _____
* _____

The answer to this self check is here in the following words so you will have to check your answer carefully. The three broad areas the customer would be concerned with are product requirements, price and delivery.

3 Measuring Quality

But quality is something which is sometimes difficult to pin down. You might recognise it in

* the way somebody answers the telephone or deals with enquiries
* the accuracy of a piece of engineering
* the texture of a piece of material
* the speed and efficiency with which a booking is taken for a holiday.

ACTIVITY 4
Time guide
4 mins

Here's a list of items or experiences with which we are all familiar. Some of these can be measured and some can't.

	CAN BE MEASURED	CANNOT BE MEASURED
Fuel consumption of your car or company vehicle		
Bouquet of a glass of wine		
Fragrance of a flower display		
Time spent washing dishes		
The taste of your favourite meal		
Your rate of pay or salary		
The feel of the material used to make your best suit		
The sound of your favourite type of music		
The size of your shoes		
The number of pages in this unit		

Tick which category you think each of them belongs to in the appropriate column on the right.

My response to that would be that:

fuel consumption
time spent washing dishes
your rate of pay or salary
the size of your shoes
the number of pages in this unit

can be measured.

On the other hand,

the bouquet of a glass of wine
fragrance of a flower display
the taste of your favourite meal
the feel of material
the sound of music

cannot be measured in the same way.

To measure the items on the 'can be measured' list we would need to use some kind of standard.

ACTIVITY 5
Time guide
2 mins

Suppose you know how much petrol your car was using for the mileage you were doing and you wanted to find out whether this consumption was good, average or it's time you put the car in for a service.

What standard would you use to measure your fuel consumption?

*

You would probably measure your car's consumption against an accepted standard fuel consumption for a car of that type, age and mileage. You might arrive at that standard by using the car dealer's information or asking around among your friends and colleagues with similar cars.

Standards can be measured in a number of different ways. In athletics, for instance, standards used include time, distance, weights etc.

This is called QUANTITATIVE MEASUREMENT.

However, we may still need to make some kind of assessment of the quality of items which are not measurable in this way, like those on our second list.

ACTIVITY 6
Time guide
3 mins

Jot down how you would assess the quality of things like the fragrance of flowers or the bouquet of a bottle of wine.

You may not have used the same words as me but I hope we can agree that we would have to make some kind of judgement based on personal intuition and previous experience.

This is called QUALITATIVE MEASUREMENT.

As supervisor, responsible for the whole picture in your workplace, you are likely to be concerned with both.

ACTIVITY 7
Time guide
2 mins

Suppose you are an office supervisor. Here is a list of factors which you might examine and control to ensure the quality of your workteam's output. Beside each one, jot down whether you think it would have to be measured quantitatively or qualitatively.

The number of letters produced in a day

The hours usage of the word processor

The receptionist's attitude to callers

Interest in the job shown by typist

Number of poor photocopies taken

Number of queries dealt with in a week

Willingness of staff to follow up queries

Time taken to type standard letters

I would divide those up like this:

Number of letters produced in a day
Hours usage of the word processor
Number of poor photocopies taken — QUANTITATIVE
Number of queries dealt with in a week
Time taken to type standard letters

Receptionist's attitude to callers
Interest in the job shown by typists — QUALITATIVE
Willingness of staff to follow up queries

We can see from some of these (number of queries dealt with and willingness of staff to follow up queries, for instance) that sometimes, in any given situation, you will be measuring different factors and that some will be quantitative and some qualitative.

So, having established that quality may be measured

QUANTITATIVELY

or

QUALITATIVELY

let's now consider how quality may be achieved.

ACTIVITY 8
Time guide
5 mins

Think about your own workplace and identify one particular product or service which is provided by your workteam. You may supply the customer directly yourself (if you work in a shop or an office or in despatch, for instance) or your 'customer' may be another department in the same workplace (if you work in stores or in one part of a manufacturing process or an accounts department for example).

Jot down two ways in which you can assure the quality of what goes out of your work area.

* _____

* _____

You may have made any number of suggestions for this but I think they will probably fall into two broad categories:

inspection - a form of "cure" where we remove faulty items

control - a form of "prevention" where we avoid faulty items being produced.

There's another related and important point about both inspection and control. It has to do with the extent of our attention to the items we are concerned with. Let's explore what we mean by this.

ACTIVITY 9
Time guide
5 mins

A busy typing pool produces, in an average day, 200 memos for internal use and 20 letters to be sent out to some very important clients. If you were the supervisor and wanted to assure quality of the typing by checking on typing errors only, then:

1 for the internal memos would you check every single memo?
YES/NO

Give a brief reason for your response.

* _____

_____

2 for the letters to clients would you check every single letter?
YES/NO

Give a brief reason for your response.

* _____

_____

Now we'd probably agree that typing errors in the client's letters could have serious consequences by showing the company in a very poor light. However, similar errors in the internal memos would show the typing pool in a poor light - but this is not as serious. In this case the supervisor might make a series of spot checks on the memos but conduct a careful proof-read of all the important letters.

This would be consistent with our concept that:

QUALITY = FITNESS FOR THE CUSTOMER'S PURPOSE.

To be fit for important clients, letters must be of perfect quality - so all letters would be checked - perhaps even re-checked.

To be fit for internal purposes, memos could be of good, rather than perfect, quality - so a sample of memos could be checked rather than them all.

Decisions about levels of inspection are made in all organisations. They make judgements about what "fitness for the customer's purpose" means and implies.

This is an important part of quality control but it's by no means the whole of the picture.

ACTIVITY 10
Time guide
2 mins

If you inspect whatever leaves your work area will it

a) ensure that the entire product is of acceptable quality

or

b) pick out any items which are defective?

Inspection will only identify items which are defective so I hope we can agree that b) is the correct response here.

You can't inspect quality into a product - it has to be there from the start and maintained at every stage.

ACTIVITY 11
Time guide
3 mins

Look at these two situations.

In factory A, morale is low, turnover of staff is high, training is non-existent and people tend not to know or care what they're doing. However, there's an efficient inspection system before goods leave and, although there's a high reject rate, they don't get many customer complaints.

In factory B, the staff are interested and well-informed about the job. Materials and equipment are frequently inspected and everybody is responsible for checking the quality of their own output against standards. Final inspection is made of fewer items than in Factory A and the reject rate is lower but they still don't seem to get many customer complaints.

Assuming that materials used and wages and so on are the same, which factory is likely to have the higher costs?

*

I think factory A is likely to have the higher costs. Although, because of thorough inspection, they may send out a product of consistently acceptable quality, they've produced a lot of rejects on the way, all of which represent a cost to the factory.

They don't appear to have any control over quality whilst the work is being done and that can't be put right by inspection at the end. Their costs appear to be uncontrollable.

On the other hand, Factory B is going to incur costs too in ensuring the quality of its product.

QUALITY COSTS

You hope that the costs won't be in reject products or unsatisfactory service which has to be repeated to be put right but there's a cost factor in the training and setting of standards, maintaining equipment and controlling at each stage.

ACTIVITY 12
Time guide
2 mins

Would you say that the cost of training, of taking time to set standards and of maintaining equipment is

a) an uncontrollable cost

b) a controllable cost?

In the last activity we mentioned a few of the areas which can be controlled and in which 'quality' can be built in to whatever product or service you provide.

We'll probably agree that these costs are controllable costs. For example the management of factory B can decide how much they can afford to spend on doing these things to ensure the quality of whatever they produce without having to put their prices up unacceptably high.

ACTIVITY 13
Time guide
4 mins

Think for a moment about your own job. Jot down two things or people which you are responsible for where you can in some way control the quality of output from your work area.

eg the equipment you and your workteam use

* _____

* _____

This was quite a hard question and everybody is likely to think of different specific things. However, I think they can probably all be grouped under these headings:

people

materials

equipment

And, some people may be able to add to that:

. processes and procedures - the way the job is done.

Let's have a look at three of those areas now.

5.1 People

People are any company's most valuable resource. No matter how efficient the equipment or advanced the technology, the product or service offered is only as good as the human being behind it can make it.

ACTIVITY 14
Time guide
5 mins

Suppose we have a revolutionary new product - a real market winner we hope. As far as the customer is concerned it's only as good as the people he deals with or whose contribution to the job he is aware of. No matter how good the product he may not come back for more if:

* the clerk taking telephone orders is surly and unhelpful
* the salesman promises delivery dates which aren't met.

Jot down four more examples of people who can damage the 'quality' of the product in the customer's eyes.

* _____
* _____
* _____
* _____

This list could be virtually endless but here are a few examples:

* the salesman who overstates what the product will do to get a sale. No product is likely to do more than it is designed to do. Pretending otherwise creates dissatisfied customers and is bad quality selling
* the technical support team - if they can't or won't provide an after-sales service to back up the product
* production - if they don't meet production levels needed to supply what is needed
* maintenance - if they don't maintain the equipment so that production can meet their schedules
* purchasing and planning - if they haven't made the necessary arrangements and organised materials for the job to be done
* stores - if materials in stock have been poorly looked after so they have deteriorated or become damaged before use.

I can think of many more and, although the example we've used here is of manufacturing, the same principle applies whether you are providing an information service or planting trees on a remote hillside somewhere. Quality is only as good as everybody's contribution to it.

So how can we ensure that all these people are building quality into whatever we provide and how can we control it?

SELF CHECK 2
Time guide
2 mins

Complete the following statement.

When we discussed quantitative and qualitative measurement we said that you must have a _____ against which to measure.

The word we used was standard. You must have a standard against which you can measure anything from fuel consumption to expected performance by a member of your workteam.

Let's see how this idea of standards can help in controlling the quality of what the workteam does.

ACTIVITY 15
Time guide
8 mins

Suppose you have been a supervisor for a long time - perhaps ten years or more.

In that time you have had to fill vacancies in your workteam, helped in staff selection, trained workteam members and reviewed their progress, given responsibility to the people you thought could take it and seen some of them promoted as well as all the running to and fro, decision-making and following-up that is a normal part of your job.

Jot down three points in the situation I've described at which written standards would help you to ensure quality from your workteam.

* _____

_____

* _____

_____

* _____

_____

You could probably think of all sorts of instances, bearing your own job in mind. In very general terms, though, these are some of the points at which I think written standards would help any supervisor to ensure quality from the workteam.

* before taking on new staff

if a vacancy arises or needs to be created, a lot of thought needs to be given to exactly what the job should include to contribute most effectively to what the firm is trying to do and to what sort of person could best fill that job - qualifications, experience, skills and so on.

Taking on somebody who turns out to be unsuitable for a job which itself is badly defined is building in trouble from the start. This may not immediately sound like a quality control problem but it is in just the same way as attempting to make goods with poor quality materials which weren't intended for the purpose is a quality control problem - and a problem which is harder to get rid of than a batch of defective raw materials.

The standards we need here are job profiles and ideal person profiles which you can find out more about in another unit in this series, Hiring People.

EXTENSION 1
Page 74

You may not be entirely responsible for selecting new staff but a written standard of what you feel you need would probably carry some weight with whoever was making the appointment.

* training new and existing workteam members

You are probably responsible for some of the training of your workteam. Once again, to do this effectively you need a written standard to tell you and the trainee what they should be able to do to be competent. This isn't always easy to do but the time spent on it is a good investment if it avoids somebody saying:

'I never knew about that. Nobody showed me that so I've been doing it this way!' 'This way' may cause a lot of damage and result in a high wastage rate and angry customers - in other words, poor quality.

* occassional reviews

Training alone is not enough to ensure a quality performance. You need to check periodically that the training worked and decide whether it needs topping up or updating. And, of course, appraisal interviews give you the opportunity to find out more about your workteam's capabilities and possible areas of stress and strain. Are you making the best use of them? Do they need support, training, 'preventive maintenance'? You would do as much for your machines to make sure that quality was maintained. Unlike machines, people can be encouraged to think in terms of quality and to develop in their jobs.

* setting standards

If you work in manufacturing industry, you are probably used to standard operating procedures which tell you exactly how to use certain machinery and what to do in particular processes. This idea can usefully be extended to any job. It doesn't mean that everyone is buried in paperwork but it does mean that people know how things should be done, or have a standard to refer to rather than going on hearsay or finding out when they've done something wrong.

It's important, of course, that the standards can be understood easily by the people using them and that they know where to find them.

EXTENSION 2
Page 74

There's an example of a standard operating procedure for using a pool car in this extension and a suggestion for another unit in this series which you might like to follow up if you are writing instructions for other people.

Before we leave the subject of standards as far as the control of people are concerned, we ought to mention one of the most important standards which your workteam will refer to - you.

Whatever you do and whatever attitude you take to the work produced in your work area will set the standard for their behaviour.

If you are very easy-going about the quality of work produced, why should they worry? Conversely, if you are quality conscious, you can pass this attitude on to them.

Now let's move on to think abut how we can control the quality of the other resources for which we're responsible.

5.2 Materials

There's a lot of truth in the saying 'You can't make a silk purse of a pig's ear'. If the materials you use are of poor quality, the end product is likely to be of poor quality too.

ACTIVITY 16
Time guide
2 mins

Suppose you are using some material which you think is of unacceptable quality. (It doesn't matter what you have in mind. It could be raw materials in manufacturing, computer stationery, goods which you are displaying in a shop window, food being prepared in the works canteen - anything.)

Jot down what you think you should do.

How easily and in how much detail you could respond to this activity will depend very much on where you work.

You may have said that you could check the material against a written specification and, if it's out of specification, stop using it and report it immediately.

If that's the case, it sounds as though a good Quality Control system is already in operation. For the situations where there is no written specification, however, the drill is much the same.

* If at all possible, stop using the material.

* Save samples which show the poor quality you're concerned about and write down details of what's wrong to refer to later.

* Report the poor quality to your boss or the appropriate technical department who can investigate the problem further.

Picking up poor quality raw materials before they can be turned into poor quality finished products is one important aspect of the quality control of materials.

There is another, though, which is equally important to the company you work for.

SELF CHECK 3
Time guide
2 mins

Complete the following statement with two suitable words. At the beginning of this unit we said:

QUALITY = _____ for the customer's _____.

We said that quality was 'fitness for the customer's purpose'. It's just that and nothing more.

If the customer doesn't need and isn't expecting the very best you can possibly supply, then it's bad business sense and poor quality control to provide it.

'Fitness for the purpose' is something we need to think about within the workplace too.

ACTIVITY 17
Time guide
3 mins

Suppose you supervise an office and you keep the following stationery among other supplies.

* high quality headed stationery in two sizes for letters
* high quality typing paper for continuation sheets to letters
* small and large memo stationery for memos within the company
* thinner typing paper for continuation sheet for memos
* small, brown envelopes for invoices and reminders
* high quality envelopes in three sizes for letters
* pads of scrap paper for notes, telephone messages etc.

Jot down three possible ways in which more expensive materials than were necessary could be used.

* _____
* _____
* _____

If you think about it long enough you can probably think of dozens of examples.

Here are just one or two which spring to my mind.

* invoices may be sent out in high quality envelopes. This is an unnecessary expense and is an example of how, if you don't control the quality of materials you use, you are providing more than the customer actually needs.

* Larger envelopes than necessary may be used for letters. Once again, an unnecessary expense and the customer doesn't need or expect what it's costing you money to provide.

* High quality paper may be used for memos or for taking messages. Although the customer isn't directly involved, he may be in the end. If you use more expensive and better quality material than is necessary for any purpose in the workplace, you are running up an unnecessary expense which may, in the end, put you out of business.

You may not think the cost of envelopes can make or break a business but, whatever the material you're dealing with, the principle is the same.

Quality = fitness for the purpose - no more, no less.

5.3 Equipment

Now let's look at the third group of resources whose quality of performance you can control - equipment and tools.

ACTIVITY 18
Time guide
5 mins

Think of one major piece of equipment for which you are responsible. This might be a large piece of manufacturing machinery, a car or other vehicle, a microprocessor of some kind or some expensive hand tools.

Jot down three things which you should do, as supervisor, to make sure that the way that piece of equipment performs meets your quality standards.

* _____

_____

* _____

_____

* _____

_____

You may have noted any number of things, depending on the equipment you had in mind. I think that what you said, though, can probably be grouped into one or more of these three main areas of equipment control.

* Trained use

  Make sure that the equipment is handled only by people who have been trained how to use it and whom you can trust not to misuse it.

* Records

  You really need to keep two kinds of record:

  - a record of any machine breakdown time and analysis of exactly what went wrong. This helps whoever has to put it right and also helps you to understand the equipment better, including its weaknesses and limitations.

  - a record of any lubrication or repairs which will serve as a useful guide to the preventive maintenance you need to maintain quality standards.

* Reports

  Report equipment trouble as soon as it occurs including minor troubles which can often add up to major problems if they are ignored.

You may well be thinking by now that ensuring quality control in the workteam, the materials and the equipment you use sounds like a huge area of responsibility.

Up to a point you're right.

But, as you'll have realised from our discussion of controlling people as a resource, it isn't something which you should be tackling alone. Ensuring quality should become an attitude of mind which is shared by you and your workteam. Let's look finally, then, at how you can raise quality consciousness in your workteam and, thus, the quality of your output.

6 Quality Consciousness

When NASA (North American Space Agency) began a programme of manned space flights, they quickly realised that, despite rigorous checks, there were still defects in systems and components. Obviously any defect at all in a space programme was unacceptable.

Our graph for the daily sales of large brown loaves would look like

ACTIVITY 19
Time guide
4 mins

Suppose you manufacture electronic components for space craft. Your checks on materials and processes are very thorough, but how could you make the workteam take a positive attitude to the importance of quality?

Jot down two ways you could try to make them quality conscious.

* _____

_____

* _____

_____

You may have thought of any number of ways which you might like to compare with the American findings.

These can be boiled down (because the research was extensive and detailed and had all sorts of implications for management in general) to three main areas:

Communications

Responsibility for the job

Attitude to the job

These three areas contain specific advice and proper procedures in order to ensure the quality of all operations. But it does much more than this - it lets all people know that quality is not someone else's business -

QUALITY IS THE RESPONSIBILITY OF EVERYONE IN THE ORGANISATION

6.1 Communications

The evidence is that the better the communications are between managers (including you) and the people who work for them and between members of the same workteam, the better the quality control.

ACTIVITY 20
Time guide
3 mins

Jot down two reasons why you think good communications may improve quality control.

* _____

* _____

Once again, you could have suggested all sorts of reasons. Here are my suggestions, not necessarily in any order of importance.

* The free flow of information from manager to the people who work for them or from you to your workteam means that people have a better understanding of how what they do contributes to the overall effort.

  This way they are more likely to be interested in the job and to notice unusual occurrences which don't seem to fit the general pattern.

* Managers who listen, which is just as important an aspect of communicating, will learn a lot about minor changes, unusual occurrences which ought to be checked out and even possible improvements. So a free flow of information from the workteam to the supervisor and from supervisors to managers can improve quality control by providing an 'early warning system'.

* Good communication about the job between workteam members fosters an interest in what's being done for everybody and, once again, is likely to produce some good ideas for improvements and an early warning of things going wrong.

6.2 Responsibility for the job

We've already mentioned the importance of standards. If communications are good and you know the standards you are working to, it's often possible to take responsibility for a particular job yourself.

ACTIVITY 21
Time guide
2 mins

Suppose you work in a busy secretarial section. (It doesn't matter if you've never touched a keyboard in your life.)

In section A, all letters, reports etc are checked for typing errors, spelling and punctuation mistakes by the section supervisor before being sent out or passed to managers for signature. Presumaby she makes the alterations because you rarely see the letters again.

In section B, you're responsible for checking your own work. If something of poor quality goes to a manager for signature, the first you'll hear of it is a personal rocket or perhaps a request that you don't type that manager's letters in future.

In which section are you more likely to be concerned about the quality control of your work, A or B?

* _____

I hope we can agree that section B, where you are responsible for controlling the quality of your own work, is more likely to create a quality conscious attitude.

It isn't simply the fear of getting a rocket when your quality is below standard. The evidence is that the job becomes more interesting in itself if you have some responsibility for completing it satisfactorily and interest, in turn, contributes to a concern for a good quality performance.

Let's take this one stage further.

ACTIVITY 22
Time guide
3 mins

Which of the following situations is the one in which you would like to work? Tick whichever one you prefer.

a) You have no control over how much work comes in - you're expected to get it done somehow. |__|

b) Your boss sets you pretty challenging targets. Sometimes they are unrealistic but you're expected to get the work done somehow. |__|

c) You set your own targets. Nobody else really knows what your targets are but you have the satisfaction of knowing when you achieve them and nobody else knows when you don't. |__|

d) You and the rest of your workteam set your own targets in discussion with your manager and then you all aim to meet them somehow. |__|

Of course there's no one right answer to this. Attitudes to work and working relationships vary but the evidence is that most people will favour c) or d). If people respond well to having responsibility for completing a job satisfactorily, it follows that they are also likely to respond well to being involved in setting the targets for the job as well.

ACTIVITY 23
Time guide
2 mins

Here are two of those situations again, which I have said most people will favour as ways of working.

Which one do you think is likely to ensure the better control of performance. Tick whichever seems to you the more likely.

a) You set your own targets. Nobody else really knows what your targets are but you have the satisfaction of knowing when you achieve them and nobody else knows when you don't. |__|

b) You and the rest of your workteam set your own targets in discussion with your manager and then you all aim to meet them somehow. |__|

I hope we can agree that quality control of performance is likely to be better in b). Goals and targets set by a group are public (within the group at least) and interest, commitment, even healthy competition are sparked off by the fact that a number of people are involved and quality standards are more likely to be met.

Unless you are a very determined individual, achieving targets day after day on your own can be a lonely and discouraging business.

6.3 Attitude to the Job

ACTIVITY 24
Time guide
1 min

Which company do you think is likely to have a better record for quality, A or B?

In company A, the staff are generally well-disposed towards the company and interested in and well-informed about the project.

In company B, the management are very unpopular and the staff are fairly cynical about the usefulness of the product.

*

I hope we can agree that company A is likely to have a better track record for quality. It doesn't automatically follow, of course, if the staff aren't in favour of the product, it must be so much rubbish but you would have difficulty making a workteam who are hostile and cynical quality conscious. That means that you miss out on the suggestions for improvement and what we've described as the 'early warning system.'

6.4 Quality Circles

One idea which draws together the three factors we've just been talking about - communication, responsibility and attitude to the job - is the idea of Quality Circles. These are groups of people from the same work area who voluntarily get together to identify and solve problems affecting the quality of their work output. To work successfully, Quality Circles need to be carefully set up and need the whole-hearted support of management.

EXTENSION 3
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What's involved in setting up and running Quality Circles is quite an extensive subject and is dealt with in another unit in this series, Quality Circles.

I hope we discussed enough in this part of the unit to set you thinking about what 'quality' means to you in your own workplace and about areas in which you can control the quality of work done. To help you focus your thinking, you might find it useful to ask yourself the questions on this checklist and to keep it by you for future reference.

CHECKLIST FOR ENSURING QUALITY CONTROL

* How often are complaints directed specifically at you personally, your workteam or the work area you supervise? Are they justified? Are you doing anything about them?

* How much scrap or reworking is produced in your work area? Have you set written performance standards which your workteam know about?

* Are your workteam quality conscious?

* Has performance in your work area been improving or sliding in the last few months? Do you know why?

* Do you look for ways of improving performance in your work area without being asked?

* When did you last make a constructive suggestion for improving the quality of the product or service you provide?

* What do you do when sub-standard performance is brought to your attention?

* How often do you carry out checks to make sure quality standards are met?

* Do you include quality consciousness in your training plans for your workteam?

* Do you acknowledge high quality performance from your workteam?

SELF CHECK 4 Respond by completing each sentence with a suitable word or words.

Time guide
8 mins

a) Quality can be measured _____ or _____.

b) To measure quality you must be able to _____ performance against a known _____.

c) Two ways you can ensure the quality of a product are _____ and _____.

d) Quality = Fitness for the _____ _____.

e) Quality is a _____ cost.

f) The resources whose quality you can control are _____, _____ and _____.

g) Three ways you can encourage quality consciousness in your workteam are _____, _____ and _____.

The answer to this self check is here in the following words so you will have to check your answer carefully. a) Quality can be measured quantitatively or qualitatively. b) Either depends upon measuring performance against a known standard. If you are measuring quantitatively this may be output per hour, speed, machine usage etc. If you are measuring qualitatively, standards tend to be based on previous experience and intuition. c) The two ways you can ensure quality are inspection and control but remember quality cannot be inspected into a product at the end. The quality needs to be ensured by control systems throughout. d) Quality = Fitness for the customer's purpose - not necessarily the very best you can produce and certainly not whatever you can get away with. e) Quality is a controllable cost. Ensuring high quality costs money but, if it is under control, management can decide how much they are prepared to invest without making the price of their goods or service unacceptably high. f) The resources whose quality you can control are the workteam, the materials and equipment you use. g) You can encourage quality consciousness by good communication, giving responsibility for the work done to the workteam and by encouraging a favourable attitude to the job. You may also have said that you can encourage quality consciousness by the standard you yourself set.

7 Summary

QUALITY IS THE SILENT SALESMAN.

QUALITY IS FITNESS FOR THE CUSTOMER'S PURPOSE.

QUALITY is assured by INSPECTION and CONTROL.

CONTROL depends upon measuring performance against known standards.

STANDARDS can be QUANTITATIVE

or QUALITATIVE

Quality cannot be inspected into a finished product - it has to be ensured throughout

QUALITY CONTROL should extend to all resources you manage -

The workteam -	set a standard for selecting people for the job
	train the workteam to an agreed standard
	appraise performance
	make sure they know the standards they are working to
Materials -	check materials against specifications or standards
	save samples of poor quality material for investigation
	report poor quality and, if possible, stop using it
Equipment -	train users
	keep records of machine failure and maintenance
	report problems, even minor ones, as soon as they arise

QUALITY CONSCIOUSNESS can be encouraged by:

GOOD COMMUNICATION

GIVING RESPONSIBILITY FOR JOB STANDARDS

DEVELOPING POSITIVE ATTITUDES TO THE JOB

PART B QUALITY CONTROL AND STATISTICS

1 Introduction

In the first part of this unit we saw that quality control extends to every part of your job. Some features may be difficult to measure, such as the suitability of somebody for their job, and success will depend upon your experience and judgement. Others, such as today's output as compared with yesterday's, may be relatively easy.

Whatever it is we are concerned about, quality control comes down to measuring performance against known standards.

But how do we set about it?

Quality control involves a number of numerical techniques which are used to monitor measurable aspects of quality. These techniques draw heavily on basic statistics. There are other units in this series which deal with statistics and numerical analysis in depth, so in this part of our unit we'll simply outline some of the more important ones in a straightforward and practical way. However, if you'd like to explore these ideas further, then why not take a look at some of the other units listed in extension 4 at the back of this unit.

EXTENSION 4
page 76

Numerical values can be presented in a way which can help you as a supervisor to make decisions about things relating to quality. There are a number of statistical measures and ideas which are helpful here. In the sections that follow we'll look at some of them.

2 The Mean

The mean is our commonsense average. If most people were asked for the average of something, the figure they'd give would be the mean. Let's look at an example.

You are a supervisor in a supermarket and one of your responsibilities is to purchase the bread which is sold from your shelves. The store stocks the following types of bread:

Large white sliced, large white unsliced, large brown sliced, large brown unsliced, small white and small brown.

You jot down the daily sales for each type of bread over each of six days and draw up a table like the one below:

WEEKLY BREAD SALES

Bread	Mon	Tue	Wed	Thur	Fri	Sat	Total
LWS	140	120	160	200	260	220	1100
LW	120	100	110	140	160	180	810
LBS	120	110	100	150	150	160	790
LB	100	80	120	140	180	200	820
SW	80	120	90	100	120	80	590
SB	100	110	80	90	120	100	600
						Total	4710

You are interested in the average daily bread sales. This is obtained by summing the total bread sales and dividing this total by the number of days:

$$\frac{\text{weekly bread sales total}}{\text{number of days}} = \text{average daily bread sales}$$

In other words, using the figures in our table $\frac{4710}{6}$ loaves of bread $\frac{}{}$ days

= 785 loaves of bread a day.

SELF CHECK 5
Time guide
3 mins

Let's use our table to work out the mean number of small brown loaves sold in a day. Fill in the blanks below to find the answer.

Total weekly sales of small brown loaves = _____

Total number of days = _____

Mean number of small brown loaves sold in a day = _____

The answer to this self check is here in the following words, so you will need to check your answer carefully. Total weekly sales of small brown loaves = 600. We can read off this figure from our table. Total number of days = 6. The mean number of small brown loaves sold in a day = $\frac{600}{6}$ or 100.

Knowing the mean number of loaves of each type which we sell in a day can be helpful to a supervisor responsible for purchasing.

ACTIVITY 25
Time guide
3 mins

Suggest one or two reasons why the mean could help you in your job of purchasing bread. I've entered a suggestion myself to get you started.

eg Bread not sold on the day it's delivered will go stale.

* _____

_____

* _____

_____

There are a number of suggestions you might have made. Here are a few of mine.

* If unsold bread goes stale it may have to be scrapped.

* Unsold bread may be sold off cheaply the next day, but this means the shop will lose money on it.

* If not enough bread is purchased the shop may not be able to satisfy demand.

In other words, if we buy too much bread of a particular type it will go stale. This causes waste. If we don't buy enough bread of a particular type then our shop won't be able to satisfy demand. This reduces the quality of our service, as well as losing income for our shop. If you'd like to look at some ways of making it easier to find the mean when we have a large number of figures, perhaps you'd like to look at another unit in this series, Descriptive Statistics.

EXTENSION 4
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3 The Range

The mean daily sales figure may be helpful as a guide to our supervisor who doesn't want to stock up with too much or too little bread of any one type. However, this figure can only be a rough guide. It may happen that sales on each of the six days vary widely. Let's take another look at our sales figures for large white loaves:

WEEKLY BREAD SALES
(LARGE WHITE LOAVES)

Mon	Tue	Wed	Thur	Fri	Sat	Total
120	100	110	140	160	180	810

We can see from these figures that there is quite a difference between the number of loaves sold on Tuesday when sales were lowest and Saturday when they were highest.

ACTIVITY 26
Time guide
3 mins

What is the difference between the highest number of sales that week and the lowest number of sales that week?

If we take our Tuesday sales of 100 from our Saturday sales of 180 we can see that there is a difference of 80 loaves between the two days. We call this value the RANGE. The range is simply the difference between the smallest and the largest value. Now 80 loaves is quite a lot in relation to our daily sales, so we can see that just knowing the mean daily sales could still lead us to purchasing far too many or far too few loaves.

ACTIVITY 27
Time guide
3 mins

Can you make a suggestion in the space provided below on how we could provide another figure to guide our supervisor in purchasing bread?

Perhaps you suggested that we could measure the mean sales over a period of time for Mondays, Tuesdays, Wednesdays and so on? This would probably be a better guide. But what if some weeks are in some way different from others? People may stock up with bread before Christmas, perhaps our mean has been affected by a bread strike during which it was difficult to get bread. Our trade may have been slowed down while alterations were going on in the shop, or boosted because the supermarket chain launched a national TV advertising campaign. If we know about these things in advance we can obviously take account of them, but the figures we record during such periods are bound to affect our mean. Because of reasons like this it can be helpful to know a little more about how our sales are spread or distributed throughout the week and the year.

We'll take a closer look at this problem in our next section. However first, let's do a quick self check.

SELF CHECK 6
Time guide
3 mins

Respond to the following statements by writing either TRUE or FALSE in the space provided.

1 The range is the difference between our highest and lowest value. _____

2 Here are our weekly sales totals for the different types of loaf again:

LWS	LW	LBS	LB	SW	SB
1100	810	790	820	590	600

Our range is 520. _____

The answer to this self check is here in the following words so you will have to check your answer carefully. 1 True. This is how we defined the range in this section of our unit. 2 False. Our highest figure is 1100. Our lowest is 590. The difference between the two is 510 not 520.

We mentioned earlier that it could be useful to have a better idea of how sales are spread throughout the week or year. One way in which we can get a better picture of facts like this is to draw a graph or chart.

A chart represents a set of data in picture form which makes it easy to see the relationships between a number of different things. To be more precise, the things are called variables and charts represent the relationships between differing variables.

Charts come in many differing formats, for example:

graphs
bar-charts
histograms and
pie charts.

We'll just look at two of the formats you are likely to come across in using quality control techniques.

4 Graphs and Histograms

To construct a graph we first of all need a set of data. I have reproduced some of the bread sales data which we used in the last section.

Bread	MON	TUES	WED	THURS	FRI	SAT
Large Brown	100	80	120	140	180	200

You will need a ruler and pencil.

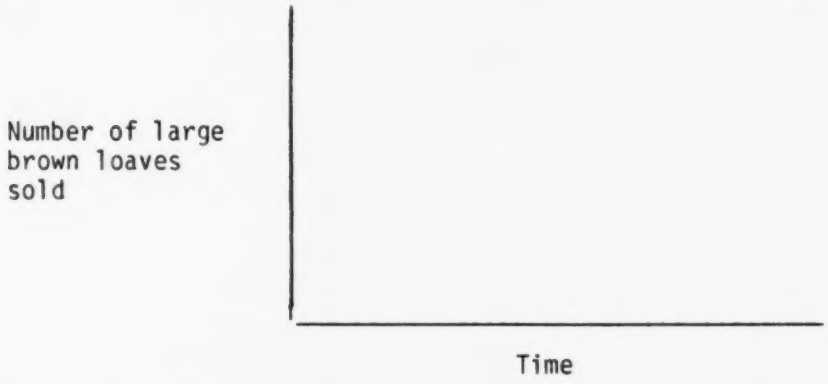
First of all we need to decide how to label the graph or chart.

In the example we're looking at, we want to record

sales of large brown loaves
on a daily basis.

This means that we want one variable, sales of large brown loaves, shown on one side of our graph and the other variable, days of the week, on the other.

So, very broadly, our graph will look like this:



These lines are called axes (just one is called an axis) and, generally, you show time on the bottom, horizontal axis.

Before we can really get down to drawing our graph however we need to decide how much data we have to record and what scale we are using.

Time, in this case, is no problem: we are just concerned with a period of one week, six working days.

ACTIVITY 28
Time guide
1 min

What is the range of values of large bread loaves sold?

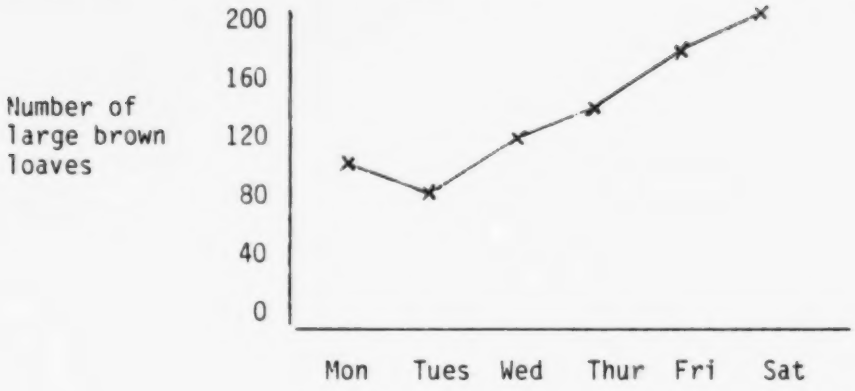
We have values from 80 to 200 - in other words a range of 120 and we have to make sure we have at least got room for that range on our graph.

In practice, it's a good idea to make your charts as large as possible. It's easier to plot points accurately on a large graph and differences between one set of data and another show up better.

Then, having decided what variables we are measuring and the scale we are using and entered them on the graph, we are ready to plot each point with a cross (x) and join up the points to produce a graph.

Our graph for the daily sales of large brown loaves would look like this.

Daily Sales of Large Brown Loaves



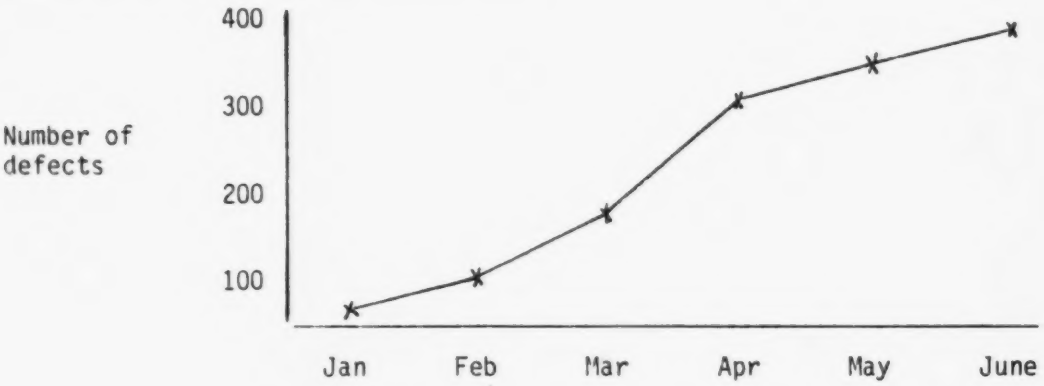
ACTIVITY 29
Time guide
3 mins

Jot down one thing which this graph tells us about how the sales of large brown loaves are distributed throughout the week. Use the space provided below.

Perhaps you noted that sales seem to be higher towards the end of the week than they are at the beginning. Graphs like this can give us a lot of information at a glance.

For example, we may be able to see that a machine producing electronic components produces more defects as time passes from its last service. Let's assume that a machine was serviced in January and is regularly serviced every six months.

Number of defects produced in a week



As the numbers of defects rise sharply between March and April, it may be worth looking into the possibility of servicing the machine every three months instead of every six.

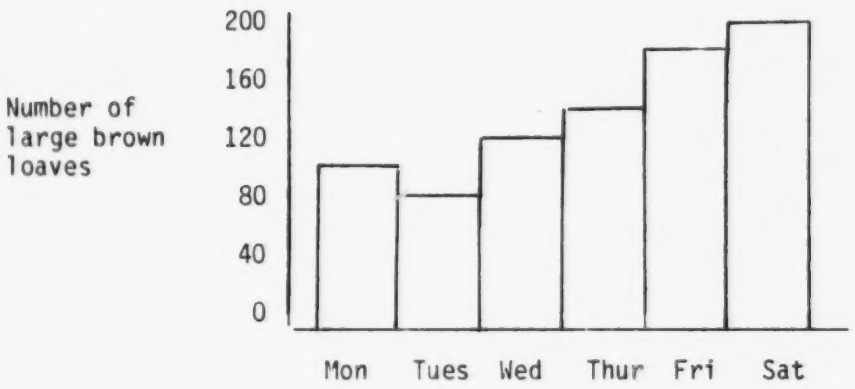
A histogram is a special type of chart which illustrates the relationships between the variables in a different way. If you draw a histogram you would construct the axes and scales as if you were going to plot a graph but, instead of plotting points with a cross, you could draw a horizontal line through each point, the width representing a day.

Here is our table showing large brown bread sales again.

MON	TUES	WED	THURS	FRI	SAT
100	80	120	140	180	200

The histogram for this data is drawn below.

Daily Bread Sales Large Brown Loaves



Again we can see that sales are higher towards the end of the week than the beginning.

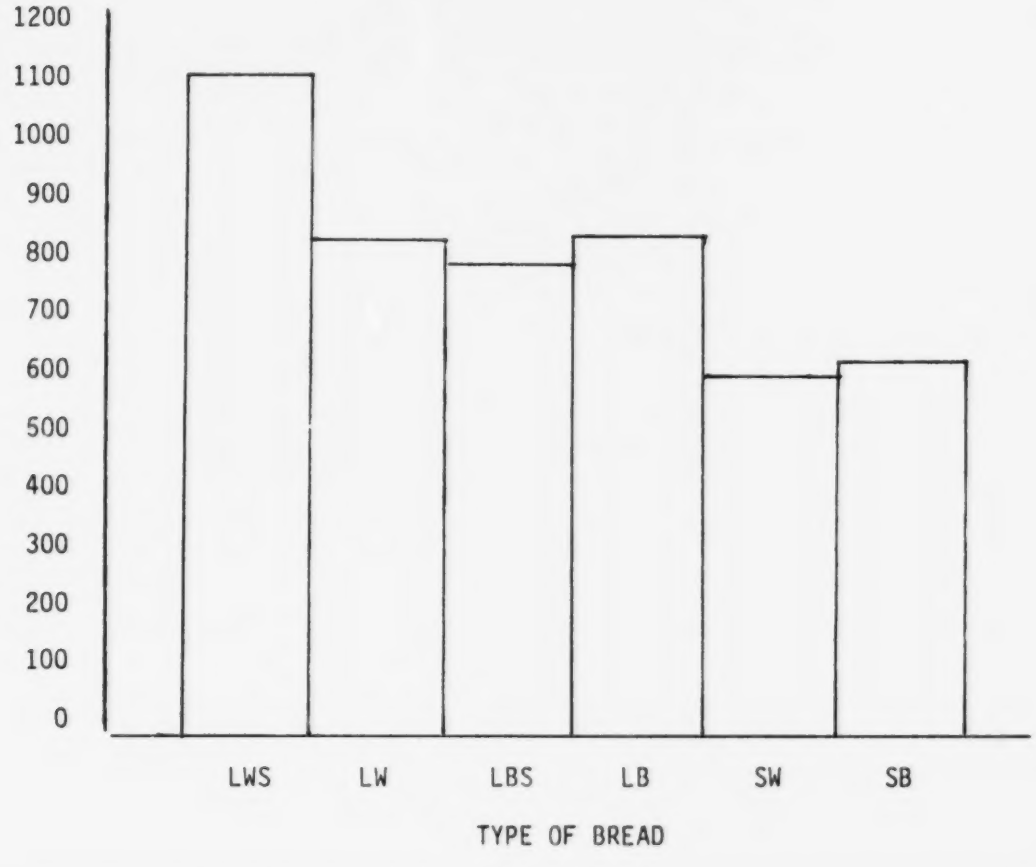
ACTIVITY 30
Time guide
3 mins

Take a look at the histogram showing total bread sales of all types.

Can you identify:

a Which type of bread seems to sell best?

b Which type of bread seems to be least popular?



The large white sliced loaf column is the tallest, so perhaps you suggested that this type of loaf sold best. The small white loaf column is the smallest so perhaps you suggested that this was the least popular.

Histograms, like graphs, help to show us how figures are distributed over a period. In other words, they illustrate a distribution. They are useful because of their visual impact.

EXTENSION 4
Page 76

If you would like to explore further examples of graphs and charts, perhaps you'd like to take up this extension to two other units in this series, Using Graphs and Looking at Figures.

Histograms are an important type of chart because they can show how data is spread about the mean.

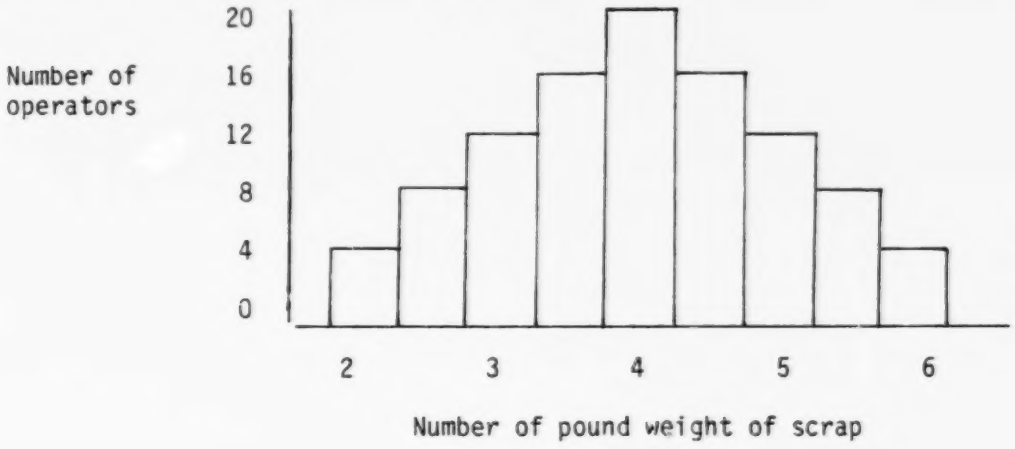
Let's look at another example. We have recorded the number of pounds weight of scrap produced by each of 100 machine operators in a week.

Number of pounds weight of scrap	Number of operators
2.0	4
2.5	8
3.0	12
3.5	16
4.0	20
4.5	16
5.0	12
5.5	8
6.0	4

ACTIVITY 31
Time guide
10 mins

Draw a histogram of this data.

The distances you've used between your values and the width of your columns may differ from mine. However the shape of your histogram should be the same. Here is the histogram I have drawn.

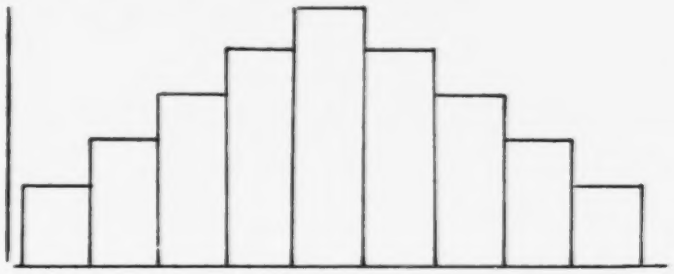


From this histogram we can see that the mean is 4 this is because the column representing 4 is the tallest and the distribution of values about the mean is the same each side of the mean.

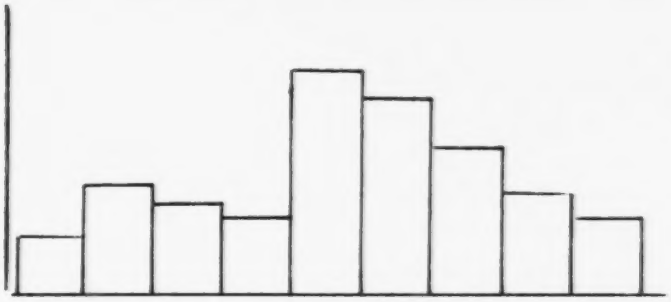
This histogram shows a type of distribution which we commonly call a normal distribution. If we think about it, this makes sense. The vast majority of people are between about 5ft 6 and 6ft. Very few are 4ft or 7ft. Similarly, a machine set to pack packets of tea with 4oz of tea will normally produce packets weighing close to this amount. It will be a comparative rarity for packets to weigh 2oz or 8oz. This type of distribution is a very useful one, because it enables quality control practitioners to make fairly accurate predictions about such things as defect rates, machine performance, sizes of shoes we can expect to sell, how many skirts of each dress size to order and so on. More of this in a moment. First a quick self check.

SELF CHECK 7 Which of the following histograms shows a normal distribution? Put a tick beside the most correct response.
Time guide 3 mins

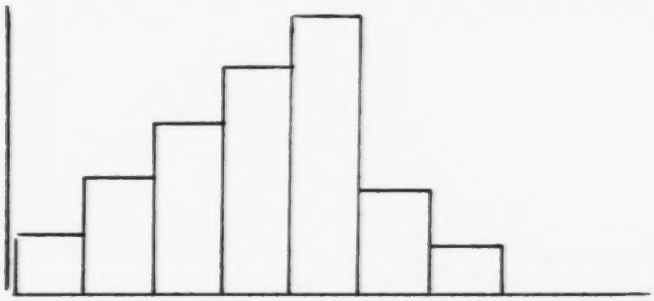
a)



b)



c)



The answer to this self check is here is the following words, so you will have to check your answer carefully. The most correct response is a). This histogram has the even or symmetrical shape which is typical of a normal distribution.

5 Probability distribution

Quality control is concerned with measurements and control. In Part A we saw that inspection is a way of picking up problems after they've happened, but to measure things like defect rates by inspecting every item we produce would be expensive. So, we only inspect some of the items we produce. In other words, we look at a sample or a proportion of our total output.

Let's illustrate this with an example. Suppose we make bars of chocolate and, in addition to the taste, we are concerned with the shape and size of the bars. A box contains 1000 bars of chocolate of which 20 fail the dimension checks in the following ways:

7 are faulty in terms of length
5 are faulty in terms of width
3 are faulty in terms of thickness
4 are faulty in terms of length and thickness
1 is faulty in terms of length and width.

In total 20 bars are faulty in the box of 1000. Suppose all the bars of chocolate are mixed up in the box then a bar is taken out. This bar will be either acceptable or faulty. If we then return the bar to the box, mix up the bars again and choose another then the second bar will either be acceptable or faulty.

If we looked at enough bars of chocolate we'd be able to make a reasonable estimate of how many we'd expect to be, say, underweight or too long as a result of our experiences of sampling or, in other words, examining these bars of chocolate.

It's more likely that quality assurance engineers or internal audit staff would do the statistical calculations to determine the size of the sample you need to take.

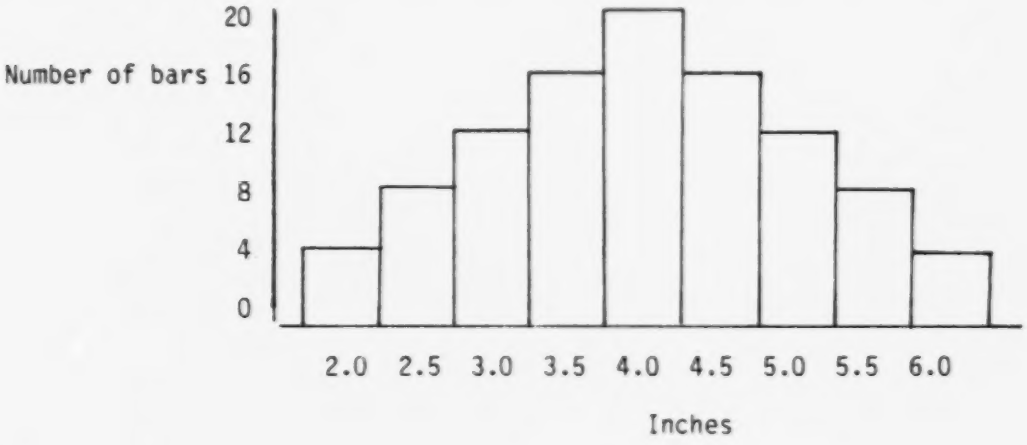
Because this probably wouldn't be your job, we won't go into too much detail about how to work out sample sizes in this unit, though I hope you will find it helpful to have a basic understanding of how we arrive at such limits.

EXTENSION 5
page 76

If you would like to know more about what is involved in determining sample sizes you might like to take up this extension.

Here is the set of data we looked at before. Let's assume we're talking about the length of chocolate bars in a sample from a cutting machine.

Length of bars in inches up to:	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Number of bars	4	8	12	16	20	16	12	8	4



As we said earlier, this type of distribution occurs very frequently.

ACTIVITY 32
Time guide
2 mins

Think of something in everyday life which affects all of us where you would expect to see a normal distribution.

Jot down your suggestion.

eg shoe sizes of people in Britain

* _____

Obviously there are thousands of examples you could have chosen and it's unlikely that we would have chosen the same examples.

The first examples which came to my mind were:

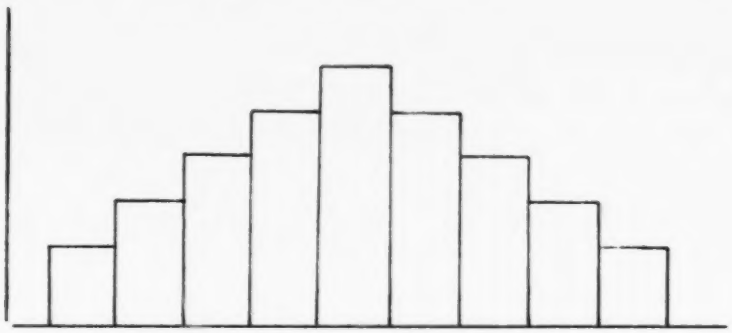
women's dress sizes
examination results
people's height or weight

With normal distribution such as these the histogram is symmetrical about the mean value.

SELF CHECK 8
Time guide
2 mins

To remind yourself of what it looks like, draw a histogram of a normal distribution below.

Your histogram should look like the one below.

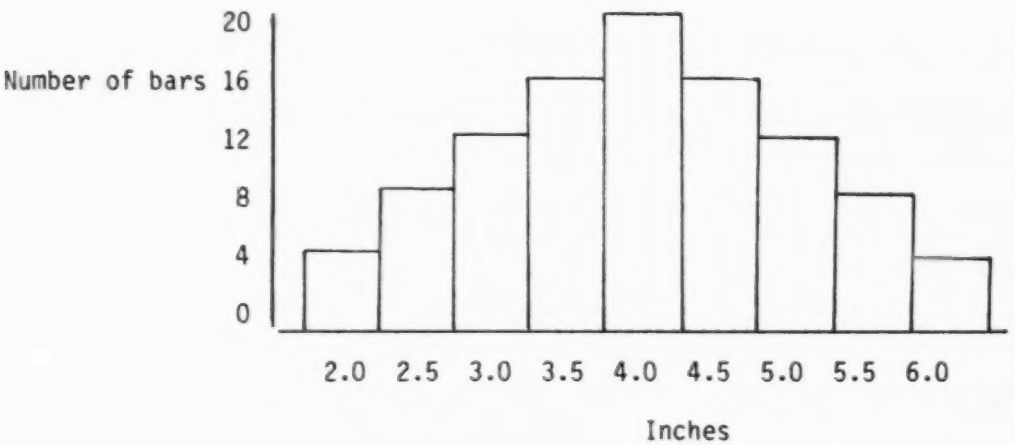


The number of bars on the scale you used doesn't matter at this stage. The important thing is that a normal distribution is bell-shaped and symmetrical.

Let's look again at our chocolate bar example.

Length of bars in inches up to:	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Number of bars	4	8	12	16	20	16	12	8	4

Our histogram looked like this.



Let's assume that our cutting machine is set to produce bars with a mean length of 3.75 inches. In other words, we have set our machine to cut bars which would fall in our 3.5 - 4.0 category.

ACTIVITY 33
Time gude
3 mins

Let's do an activity to show why the normal distribution is important in quality control. I'll jot down a few questions. You give your suggestions as to the answers in the spaces provided.

1 How many bars are in the sample in our histogram?

_____

_____

2 How many bars in our sample are over 2.5 and below 5.0 inches long?

_____

_____

We can answer questions like these by reading off from our histogram how many bars of chocolate fall into each grouping.

The total number of chocolate bars is 100. That is

$$4 + 8 + 12 + 16 + 20 + 16 + 12 + 8 + 4 = 100.$$

The total number of bars over 2.5 and below 5.0 inches long is 76. That is

$$12 + 16 + 20 + 16 + 12 = 76$$

What this means is that 76% of our chocolate bars were over 2.5 and below 5.0 inches long.

The point about normal distribution is that if we set our cutting machine at 3.75 inches we can expect 76% of <u>all</u> our chocolate bars to be between 2.5 and 5 inches long.

SELF CHECK 9
Time guide
3 mins

Let's assume we're making sweaters which should have a 34 inch chest. We take a sample and find that if we set our machines to make fronts and backs 34 inches across, 95% of our sweaters have chest measurements between 33 and 35 inches.

How many sweaters would we expect to be between 33 and 35 inches in our entire production? Answer in the space below.

* _____

The answer to this self check is here in the following words so you will need to check your answer carefully. We should have said 95%. Now if 95% is a good enough percentage for us in terms of avoiding waste, then we can happily set our machines to a setting of 34 inches.

Working out these percentages involves more statistical knowledge than we intend to cover in this unit. However if you'd like to explore the problems of normal distribution further, then why not take up our sixth

EXTENSION 6
Page 76

extension. You'll find that this book also looks at other kinds of distribution which are also useful in quality control. You'll find that working out fairly accurate percentages involves finding measures of spread other than the range. Perhaps the most useful is something

EXTENSION 4
Page 76

called the standard deviation, which is covered in the statistics units listed in extension 4.

6 Summary

Quality control techniques are based on statistics.

Mean - the average of any set of data

Range - the difference between the highest value you record and the lowest

Charts, especially graphs and histograms, can be used to record data.

A graph plots one set of variables against another to a scale.

A histogram shows data as vertical bars.

Many histograms will show normal distribution ie a symmetrical bell-shaped curve either side of the mean.

PART C CONTROL DATA AND CONTROL ACTION

1 Introduction

In Part B of this unit we saw how a basic understanding of statistics can help in quality control. Now we'll look at some specific techniques for controlling quality which draw on that statistical knowledge and see how they can contribute to better quality decision-making.

2 Sampling

It is usually unnecessary, in large scale production, to inspect and measure every item we produce. We can usually monitor what is happening fairly successfully by looking at samples or selections of whatever it is we produce. This doesn't just apply to production in manufacturing industry.

* Auditors sample invoices to check that they've been dealt with properly.

* Insurance companies can work out the risk of insuring an eighteen year old driver for a high performance car because they have statistical samples of how many eighteen year olds have caused accidents in the past.

Quality, of product or service, can be monitored using basically the same techniques.

Whether we want to check that our invoices are being sent out on time or that our chocolate bars are the right length, we need to take samples. Having done that we then have to make sure that we can record data about these samples in a meaningful way so that we can take action as necessary.

Let's assume that we work in a section which makes washing machine spindles. The diameter of the shafts should be 52 millimetres. These shafts won't fit the machine if they are more than 0.05 of a millimetre larger or smaller and so would have to be scrapped. If they begin to get too large or too small then one of the machines can be reset.

ACTIVITY 34
Time guide
3 mins

Jot down one way you might keep a watch on the diameters of shafts made by your workteam.

* _____

_____

_____

As we've already mentioned that the inspection system is one way of monitoring things like this, perhaps you suggested that we should inspect some or all of the shafts. In other words, measure them to see if they meet the size requirements. Now, it is unlikely that we'd measure every single shaft.

ACTIVITY 35
Time guide
3 mins

Think for a moment about why we wouldn't measure every shaft and jot down two possible reasons.

* _____

* _____

_____

Perhaps your suggestions are among the following.

* It would be expensive to inspect every shaft.

* We could slow down production by measuring every shaft before it was passed to the next stage.

* Inspection only picks up defects after they've happened but even a 100% inspection doesn't pick up all defects.

This last suggestion may seem strange but it is a fact that even if we do inspect every shaft, the chances are that over- or under-sized shafts would still slip through the net. If you find this hard to believe, try the following short activity.

ACTIVITY 36
Time guide
3 mins

The paragraph below contains a jumble of letters. Count how many times the letter "A" appears and write your answer in the space provided. Only count the letters once. If you repeat the exercise this would be a 200% inspection.

ALBABLACXYZRABASAABATUVWABAAC
CARYNCAARABCTARACWUEOVAACTUPM
ACDATABAUABATRUVACDETSRFGABCR
CAPACTARAVUTACTVABARACATCABRS
ABCAFGRATAACTACRPQAARAQSTAABR
RSBCTVACRSVDPQRTVOUEARSPQRTVP

"A" appears _____ times.

If you concentrated hard on this activity you may have got this right (the actual number is fifty) but a lot of people will have missed an "A" or two or else counted one twice. So, what we'd be likely to do to monitor our diameter sizes is to take a sample of spindles, say perhaps every ten minutes, from the end of our production line. We could measure the diameters of these samples and then record them.

ACTIVITY 37
Time guide
3 mins

Here are a few ways in which we might record the diameters of the spindles in our samples. Put a tick beside the method you think would be best to use.

a List them in columns.

b List them in rows.

c Draw up a table with headings like this

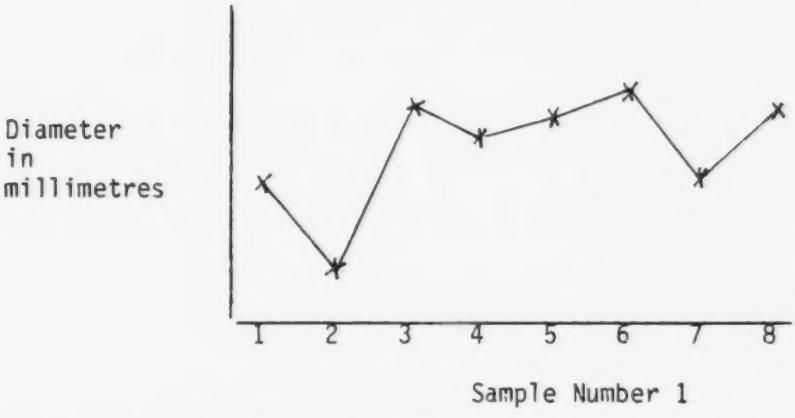
Diameter	Number of Spindles
48mm - 49mm	1
50mm - 51mm	3
52mm - 53mm	1

d Draw a graph.

I hope we can agree that a graph would be the most effective way of showing what was happening. It would enable us to see at a glance whether the diameter was tending to get bigger or smaller or staying about the same.

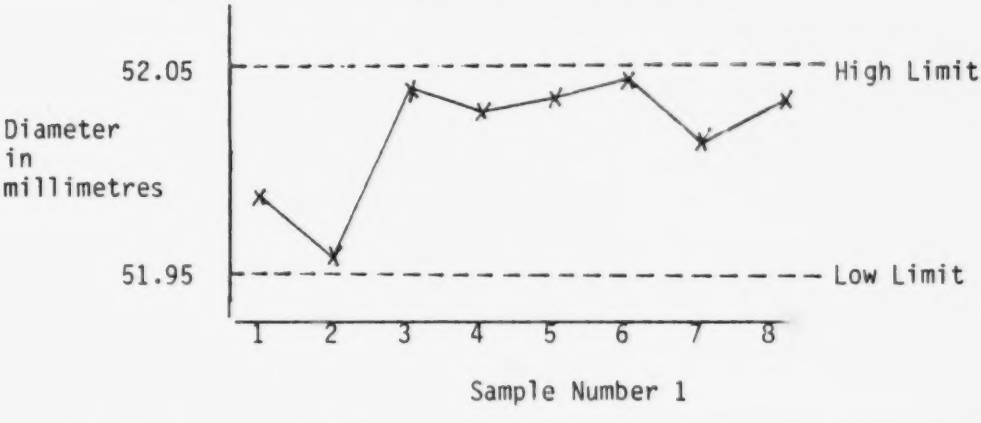
Let's assume we took a sample of 8. We could show their diameters on a graph like the one below.

GRAPH OF SPINDLE DIAMETERS



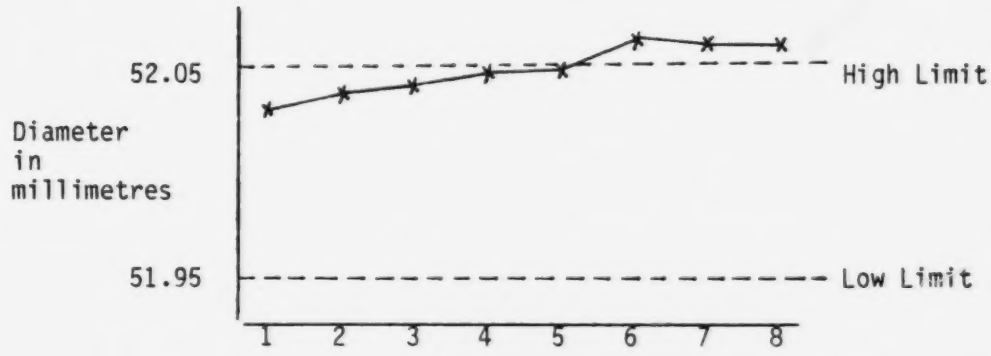
Now, we know that spindles will be scrapped if they are more than 0.05mm bigger or smaller, so we could draw these lines on our graph to see how close we were to producing scrap. Our graph would then look like the one below.

GRAPH OF SPINDLE DIAMETERS



Let's assume that our next sample produces some spindles which are over 52.05.

GRAPH OF SPINDLE DIAMETERS



ACTIVITY 38
Time guide
3 mins

Jot down how many of the spindles in this second sample are scrap.

* _____

Three spindles from the second sample would be scrap. Now by monitoring the way the diameter of spindles is increasing, it should be possible to detect this tendency before we get to the point of producing scrap, and reset the machine.

ACTIVITY 39
Time guide
3 mins

The graph we've drawn above isn't very helpful if we want to reset the machine before we start producing scrap. Write a suggestion as to why not in the space provided below.

* _____

_____

_____

_____

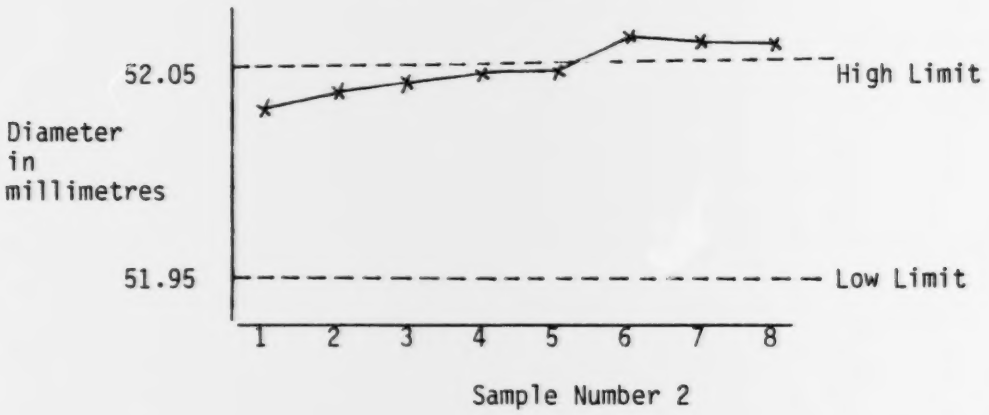
The main problem with our chart is that it doesn't tell us when to reset the machine. So, control charts usually include other lines to help us. Let's move on to see what these other lines are.

3 Mean Control

We have already accepted that inspecting the finished product does carry the risk of producing scrap items. What we want to do is to find a way of installing control and so prevent defective items being produced in the first place.

Here's the graph we referred to earlier:

GRAPH OF SPINDLE DIAMETERS



ACTIVITY 40
Time guide
2 mins

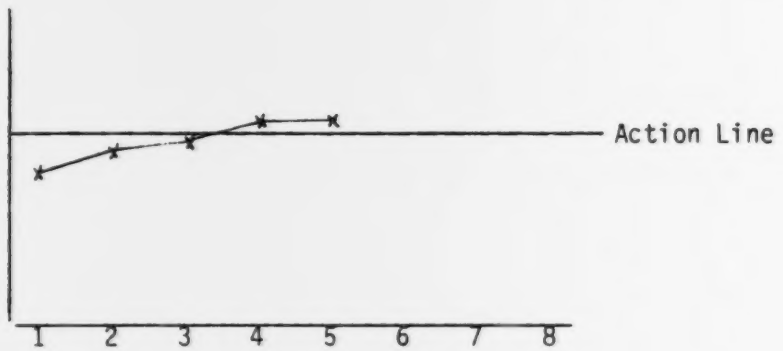
What could we have done to prevent items 6, 7 and 8 from being produced oversize?

* _____

_____

_____

Well we could have forecast that the items are gradually getting larger and adjusted the machine before item 6 was produced. So rather than drawing a "high limit" line on our graph we could have drawn a different line across our graph inside this high limit. We could then decide to take action as soon as our graph crosses this line. Let's do this just to illustrate our point.



We'll call this our Action Line. If we now act in the right way items 6, 7 and 8 will be produced to the right size. So our Action Line is a good start and is an improvement on our previous line.

But we can get even better results by drawing another line inside this Action Line to give us a warning that action may soon be needed. The main benefit of this is that measuring spindles takes time and during this time more will have been produced. Having what we will call a warning line, alerts the producer to be more watchful of each spindle coming from the machine and to take an early opportunity to make a preventative adjustment. Clearly these two lines refer to spindles near to their upper limit of size - we can also put similar lines on our graph near to the lower limits.

So how do we decide where on our graphs to put these lines? Well they are set by quite complicated statistical calculations. Fortunately we dont need to trouble ourselves with these here. Instead we can use published tables based on these calculations to save our time and energy. Let's see how we can calculate the position of our lines.

Here is the formula we use - we need to locate our upper limit lines and our lower limit lines

Upper limit = X + (A x W)

Lower limit = X - (A x W)

Where X is the average of all previous samples

W is the range (the difference between the largest and the smallest of the items in the sample)

A is the appropriate factor from the following table.

Here is an extract from the table of control factors which you would use:

SAMPLE SIZE n	WARNING FACTOR	ACTION FACTOR
2	1.229	1.937
3	0.668	1.054
4	0.476	0.75
* 5	* 0.377	* 0.594
6	0.316	0.498
7	0.274	0.432
8	0.244	0.384
9	0.220	0.347
10	0.202	0.347
11	0.186	0.294
12	0.174	0.274

* You see that I've marked the warning factor and action factor we need given a sample of 5 which is what we are going to assume for the next activity.

First of all, let's concentrate on working out the values of the upper and lower warning limits.

We'll assume that, this time, we're dealing with another type of spindle which should have a diameter of 3mm.

So, in this example:

the average of all samples = 30

the sample size = 5

and we'll say the range = 0.6

Now let's work out the upper and lower WARNING LIMITS using our formulae and the factors taken from the table.

Upper limit = $X + (A \times W)$

Lower limit = $X - (A \times W)$

ACTIVITY 41
Time guide
2 mins

Using the information you've been given and the table, fill in the figures you need to work out this formulae for the warning limits in our example.

Upper warning limit is + x =

Lower warning limit is + x =

The figures you need are:

Upper warning limit = 30 + (0.377 x 0.6)

Lower warning limit = 30 - (0.377 x 0.6)

So if we go on and work those out we find:

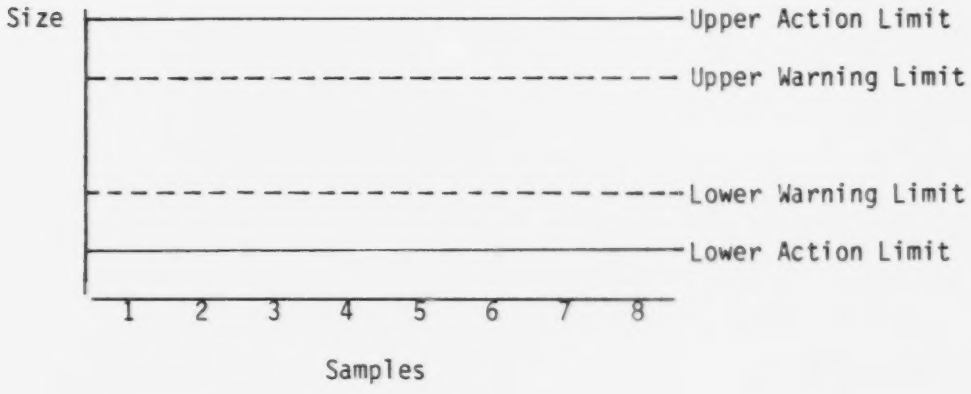
Upper warning limit = 30 + 0.2262

= 30.23 (approx)

Lower warning limit = 30 - 0.2262

= 29.77 (approx)

We could repeat these calculations for the upper and lower Action limits by using the Action factor rather than the Warning factor. These four lines can then be put onto a chart where we would then plot our graph. the chart would look like this:



SELF CHECK 10
Time guide
10 mins

Now try this example on your own to check out your understanding of how to use these formulae and the tables.

Suppose your company makes cleaning liquids based on certain chemicals dissolved in water. If the solution is too weak it won't clean, if it's too strong, it may damage the surfaces it is supposed to clean. If you test the density of the liquid you can tell how much of the chemicals is dissolved in the water. You do this by floating a device in the liquid during the bottle-filling operation and reading off the figure displayed which you record on a graph.

Calculate the upper and lower warning limits if:

the average density of all samples = 1.02

the range = 0.02

the sample size = 10

Here is the table of factors once more for you to refer to

CONTROL LIMIT FACTORS

SAMPLE SIZE n	WARNING FACTOR	ACTION FACTOR
2	1.229	1.937
3	0.668	1.054
4	0.476	0.75
5	0.377	0.594
6	0.316	0.498
7	0.274	0.432
8	0.244	0.384
9	0.220	0.347
10	0.202	0.347
11	0.186	0.294
12	0.174	0.274

Upper warning limit =

Lower warning limit =

Here is the answer to that self check.

Upper warning limit = 1.02 + (0.202 x 0.02)

= 1.02 + 0.00404

= 1.024 (approx)

Lower warning limit = 1.02 - (0.202 x 0.02)

= 1.02 - 0.00404

= 1.016 (approx)

4 Range Control

We have already explored the value of the range in helping us to control any process, so let's see how we can exercise control over the range itself. We do this via a Range Chart.

Before getting down to our calculations let's establish how the range can have an effect on mean control, through an example. As I write I have a box of matches here on my desk; printed on the matchbox are the words "minimum content 47 matches". Let's look at the quality control implications of this guarantee.

ACTIVITY 42
Time guide
3 mins

We will assume that there is an automatic counting device which feeds the counted matches into each box. Now we know that very high speed devices like this, counting very cheap items, as matches are, will not be 100% accurate every time. We can see this by checking on the Range of contents in samples of 5 boxes. Here are the results taken from production line A:

Line A - Range in contents is 4 ie some boxes will contain 2 matches more than the target mean and others 2 matches fewer than the target mean.

What would be the Target Mean in order to ensure "minimum content of 47 matches"?

* _____

For Line A, we know that if we aim at 47 as our mean then about half the boxes would have two fewer than 47 - that is 45. So to assure 47 matches we'd have to set our mean at 49 - so in order to guarantee at least 47 matches we actually provide 49 on average.

ACTIVITY 43
Time guide
3 mins

Here's some similar data for match boxes on another production line - Line B.

Line B - Range in contents is 8 ie some boxes will contain 4 matches fewer than the target mean, others will contain 4 matches more than the target mean.

What would be the target mean in order to ensure "minimum contents of 47 matches".

* _____

Using the same logic as before for Line A we would need to set the target mean at 51 matches. So to guarantee 47 matches per box we actually provide 51 matches on average.

Let's summarise our findings:

Line A - Range 4 Mean 49

Line B - Range 8 Mean 51

So we now see how important control over the range is - Line B is much more costly to the company than Line A.

MEAN CONTROL AND RANGE CONTROL ARE INTERRELATED AND EQUALLY IMPORTANT TO OVERALL PRODUCT CONTROL.

Another point arises, and this is important too. If Line B sets out to control the mean at 51 then as soon as the mean falls to 50, as it might, then some boxes would then only contain 46 matches ie 50 minus 4. Our guarantee is invalidated. For line A however we could set our mean at 50 and allow our mean to drift to 49, but we would still be able to meet our guarantee.

We can summarise this point:

WHEN THE RANGE IS LARGE THE MEAN MUST BE TIGHTLY CONTROLLED BUT WHEN THE RANGE IS SMALL THE MEAN MAY BE LESS TIGHTLY CONTROLLED.

It is clearly sensible to exercise control over the range and the mean - together they help us control quality in a way which reduces costs.

To construct a range chart we have to carry out a few more calculations.

First we need to know the mean sample range.

We already know how to calculate the average or mean of a group of figures. Using this same method we can calculate the mean sample range from a group of sample ranges.

Having got the mean sample range we use this formula to determine the control limits:

Control limit = D x W

where W is the mean sample range

D is the appropriate value for the sample size taken from a table of range chart control factors.

Here is an extract from the table

RANGE CHART CONTROL FACTORS

SAMPLE SIZE n	WARNING FACTOR	ACTION FACTOR
2	2.81	4.12
3	2.17	2.98
4	1.93	2.57
5	1.81	2.34
6	1.72	2.21
7	1.66	2.11
8	1.62	2.04
9	1.58	1.99
10	1.56	1.93
11	1.53	1.91
12	1.51	1.87

ACTIVITY 44
Time guide
5 mins

Suppose you have a mean sample range of 12 and you take a sample of 5 items.

What would the warning and action limits be?

Range Warning Limit =

Range Action Limit =

Here's a check on your calculations:

Range Warning Limit = D x W

= 1.81 x 12

= 21.72

Range Action Limit = D x W

= 2.34 x 12

= 28.08

SELF CHECK 11
Time guide
5 mins

Work out the range warning and action limits for a sample size of 10 which has a mean range value of 5.

Range Warning Limit =

Range Action Limit =

Here are my calculations to compare with yours

Range Warning Limit = D x W

= 1.56 x 5

= 7.8

Range Action Limit = D x W

= 1.93 x 5

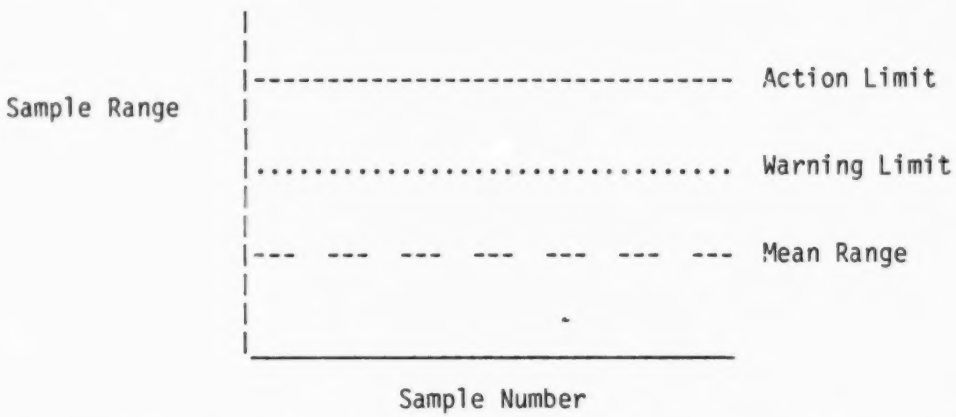
= 9.65

ACTIVITY 45
Time guide
3 mins

We've already looked at control charts. Now you know that a range chart shows a warning and action limit line, assuming a known mean sample range.

In the space below, draw roughly what you think a blank range control chart should look like and fill in the appropriate headings.

My range chart looks something like this:



We can see that this is similar to our previous Quality Control Charts except we don't have lower limits.

SELF CHECK 12
Time guide
8 mins

Complete the following statements with a suitable words or group of words.

a) Production can be monitored by taking _____ of what is produced.

b) Control charts show upper and lower _____ limits and upper and lower _____ limits.

c) _____ _____ monitor the range of samples.

d) The range is the difference between the _____ and _____ items in the sample.

e) Quality Control charts give us control data but, in order to exercise control, _____ is needed.

f) We take action only when we have considered data on the _____ chart and the _____ chart.

The answers to this self check are here in the following words so you will have to check your answer carefully. a) Samples; how large that sample needs to be would be worked out statistically by quality control specialists. b) warning, action. c) Range charts. d) Smallest, largest. e) Action; obviously if the job is under control no action is needed. f) Mean, range; by considering these two together we can often pinpoint the source of the problem and so guide our action.

5 Control Action

OK, we have developed some good ideas about Control Charts, for both the mean and the range. We know that these charts give us sound information on which we can act - we also know that Mean Control and Range Control are related. So how do we interpret the data we have before us on these charts? Let's deal with this by posing two questions:

What Action do we take when Mean gets to our Action Limit?

and

What Action do we take when Range gets to our Action Limit?

by posing these two questions we are perhaps suggesting that these actions may be different - let's see how.

ACTIVITY 46
Time guide
5 mins

A small automatic guillotine cuts 2" lengths of plastic strips from a continuous roll. The length of the strip is set by an end stop which in this case is set at 2". An automatic device feeds the strip up to the end stop and a cutter then advances to cut the strip.

Two quality control charts are kept, one recording the mean length of samples of five and the other the range in lengths of the same sample.

What action would you recommend for the following circumstances:

1 the Mean length has been gradually increasing and now is over the upper action limit?

* _____

_____

2 the Range has gradually increased and is now over the action limit?

* _____

_____

Where the mean is getting out of control we could suggest readjusting the end stop - perhaps the continuous movement of the machine has moved the end stop out of position. When we come to the range it's not quite as easy to be sure of our action. It does seem, however, that something is wrong with the automatic feed device. The strip may not always be precisely located up against the end stop - there may be a build up of dust and dirt which prevents this. It could be a job for the maintenance people, the mechanism itself may be faulty or the fault could lie in the cutter mechanism itself.

Our example does illustrate that the reasons for lack of Mean control are different from the reasons for lack of Range control. So we can see the value and the reasons for having both forms of chart. They not only give a guarantee of quality, they help us pinpoint the reasons for lack of control so we can act accordingly.

6 Acceptance Sampling

We have already noted that the warning and action limits on our charts are derived from statistical calculations. Fortunately these calculations do not have to be done "from scratch" every time a chart is set up. There are many standard documents already published which simplify the work and allow limits to be more easily calculated. One very valuable source of help is the British Standard 5750 - this contains many tables and formulae which saves us time and also gives advice about planning our systems of control. These sampling plans, as they are called, give for example the required sample size, acceptance and reject numbers, and the levels of risk of defectives for producers and for customers receiving a consignment.

REFERENCE 1
page 77

These plans, and of course our charts, can be applied to items which are either defective or not eg transistors either work or they don't, a letter contains typing errors or it doesn't.

Whatever the quality problem we can be sure that Quality Control can be applied as an effective solution.

7 Summary

Control can be exercised via Sampling.

Inspecting every item is expensive and doesn't always give 100% guarantee of perfection.

Quality Control Charts help us monitor quality.

Our Mean and Range charts include Warning and Action Limits which help us exercise control.

Range control helps in Mean Control:

if Range is large - mean control must be tight

if Range is small - mean control is easier.

Our Charts give us data - to exercise control we use this data to initiate Action.

Sampling Plans can be drawn up from already published tables.

PART D - PERFORMANCE CHECKS

1 End Check

Time guide 60 mins

You may review your understanding of the Unit as a whole by completing this group of questions. DON'T GUESS THE ANSWERS - if you're not sure, flick back into the Unit and check before responding.

If you are still unsure then put a question mark against your response before proceeding.

TRUE/FALSE

Respond to each statement by writing TRUE or FALSE in the space provided.

1 Quality control is ensured by careful inspection. _____

2 Quality control is the responsibility of the Quality Control Department only. _____

3 Quality is a controllable cost. _____

4 Quantitative measurement is based on experience and personal judgement. _____

5 A normal distribution can be shown as being symmetrical either side of the mean. _____

6 The quality of performance of all resources can be controlled. _____

7 Raising quality consciousness is the same as motivation. _____

8 Checking every item is the only way to control quality. _____

COMPLETION

Respond by completing each sentence with a suitable word or words.

9 Quality = _____ for the customer's _____.

10 Quality is the silent _____.

11 Quality is determined by measuring performance against known _____.

12 Good _____ between you and the workteam, about the importance of achieving standards, helps to create _____ _____.

13 Quality standards may be quantitative or _____ .

14 Quality control calculations are based on _____.

15 The _____ is the average of a set of values.

16 Charts for mean control show upper and lower _____ and _____ limits.

MULTIPLE CHOICE

Respond to each question by putting a tick against the ONE answer which is most correct.

17 Which of the following allows you to see at a glance whether items in a sample are acceptable quality?

a) a normal distribution curve

b) a graph

c) a mean and range chart

d) a histogram

18 Which of the following monitors the variation between items in a sample?

a) a histogram

b) a mean chart

c) a range chart

d) a graph

19 Which of the following is most likely to encourage your workteam to achieve a high quality performance?

a) setting very high standards to work to

b) setting standards which are easily achieved

c) letting them set their own standards

d) involving them in the need to achieve the required standards

20 It's better if quality standards are

a) known only by the Quality Control department

b) private, so they can be changed from time to time

c) commonly known

d) commonly known and written down

21 Which is the range of the following set of values?

32 60 18 103 81

a) 213

b) 85

c) 53

d) 71

22 Controlling the Range has a bearing on Mean control, therefore:

a) if Range is large - mean control is easier

b) if Range is small - mean control must be tight

c) if Range is small - mean control is easier

d) if Range is large - mean control is not possible.

23 The formulae for calculating upper control limits is

X + (A x W) where:

a) X is the sample size, A is the appropriate factor from the table, W is the range

b) X is the average of all samples, A is the sample size, W is the range

c) X is the average of all samples, A is the sample size, W is the appropriate factor from the table

d) X is the average of all samples, A is the appropriate factor for the sample size from the table, W is the range.

24 Quality Control is achieved by:

a) setting up control charts for mean and range

b) taking action every time the mean reaches the Warning limit

c) taking action when the range reaches the Warning limit

d) taking action when either the mean or the range reach their action limits.

END CHECK - Checkout

Audio Tape Side 2

The answers and explanations for these End Checks are on Side 2 of our Audio Tape. Have your responses with you as you play this tape. As you listen you can check out how well you have done and make notes as you proceed.

2 Tutor Check

Time guide 60 mins

Read the following case incident, then deal with the accompanying questions.

Ibex Plastics Ltd manufacture sheets of laminated material. Part of the process involves the sheets passing through a drying and curing stage in an oven.

Process standards have been established and one of these involves setting the drying and curing heads in the oven to a distance of 25 centimetres from the sheets being processed. If the heads are lower than this, the air flow is reduced and the process takes longer.

One day, the Production Supervisor, Tom Dawson, notices that the laminate sheets were warping. In his experience, this was usually caused by the air flow being too great during drying. So he told his workteam to bring the drying and curing heads down to 20 centimetres from the sheets being processed. This seemed to solve the warping problem and production continued without further problems for the next nine weeks.

Then, a major customer changed his requirements and new standards were issued to Tom's section. These were based on the original standard of 25 centimetres which was only referred to briefly in the new recommended settings for the drying and curing oven. There didn't seem to be any problem and a long production run took place.

However, when the newly-manufactured sheets were cut to size, the surface of several of them began to crack and craze - a problem usually associated with increased drying and curing times.

An investigation was held and the cause of the problem was found to be the fact that the drying and curing heads were now set at 20 centimetres instead of the recommended 25 centimetres.

Here are some comments which were made at the meeting following the investigation.

Tom Dawson, Production Supervisor:

> "We had to bring the heads down to 20 centimetres because of a warping problem. It's worked for nine weeks without affecting the quality. How come it's our fault all of a sudden? Anyway adjusting the heads don't make that much difference. I know about the adjustment - how much we'd adjusted it and so on - and I was on hand if anything went wrong.
>
> When we got the production schedule for the new order it just said curing and drying head height as previous order! Look I've got a copy of it here. Nothing there about the head height having to be 25 centimetres precisely!"

Alan Laird, Production Manager

"I'm sorry, I think the responsibility for this lies fair and square with the Quality Control Department. How is it that their monitoring system didn't pick this up months ago?

We're just concerned with getting the product out - somehow - and I depend on the people in my department, like Tom, to know the ropes. What he doesn't know about that oven isn't worth knowing."

Anne Scott, Quality Control Manager

"You can't hold Quality Control responsible for every adjustment made in the factory. Especially when we're not even informed about them. That adjustment should have been approved by Process Control and any change from standards should have been recorded and reported."

Now answer the following questions.

You only need to write ONE or TWO sentences for each one.

1 What do you think is wrong with the quality control system in this company?

2 What criticisms would you make of Tom Dawson's comments at the meeting?

3 Do you agree with Alan Laird's view that quality control is the responsibility of the Quality Control department? Give reasons for your view.

4 Suggest how a recurrence of this problem could be prevented.

Send to Tutor

Now get your answers to your study tutor either by post or handing it over personally. You will receive your tutor's assessment and comment back through the post as soon as can be managed.

3 Work-Based Project

Time guide 60 mins

Think about your own job and the resources for which you are responsible. These will include any or all of these:

- the workteam
- materials
- equipment and machinery
- money
- information

Jot down what you now see as your main responsibilities for quality control of these resources.

Describe how you plan to monitor and improve your quality control of resources you are responsible for.

Send to Tutor

Now get your answers to your study tutor either by post or handing it over personally. You will receive your tutor's assessment and comment back through the post as soon as can be managed.

PART E UNIT REVIEW

1 Return to Objectives

Having completed your work on this unit let's review how you feel about each of our four opening objectives. I'll repeat them here and add comment.

You should be better able to

* DEFINE QUALITY CONTROL AND IDENTIFY WAYS TO ASSURE QUALITY IN ALL ASPECTS OF THE JOB

We saw that quality is 'fitness for the customer's purpose' and that we can recognise 'quality' in every aspect of our working lives. It isn't just something which only applies if we actually manufacture goods, nor is it something which can be left to one department. This means that, as supervisor, you are responsible for the quality of all the resources you manage - the workteam, materials, equipment, money and information - and you need continually to be measuring performance in all those areas against known standards to really exercise quality control.

You should be better able to

* CREATE "QUALITY CONSCIOUSNESS" IN YOUR WORKTEAM

The aim of quality control is to build in quality right from the start. Involving the workteam in discussions about quality, keeping them informed of developments and getting them to contribute to the standards set in your work area will all help to make them quality conscious and to build in quality throughout the job.

You should be better able to

* USE QUALITY CONTROL TECHNIQUES TO MONITOR THE QUALITY OF WHAT IS PRODUCED IN YOUR WORKPLACE

We've seen that taking samples of whatever is produced in your work area, be it typed reports or sheets of steel, and measuring those samples against acceptable standards is the key to quality control - a general impression of how things are going is no substitute for information systematically collected. If you work in manufacturing industry, the number of samples you should take and the standards they should meet are probably given to you already. In that case I hope you will have found it interesting and useful to see how these techniques are arrived at. If instructions for quality control sampling aren't given to you as part of your job, perhaps you now feel that you have some ideas for applying these techniques in your own workplace.

Finally, to our last objective.

You should be better able to

* **USE QUALITY CONTROL INFORMATION TO MAKE SOUND DECISIONS**

Setting known standards against which to measure performance and systematically collecting information are at the heart of sound decision making. Data collected in this disciplined way will ensure that decisions for action are soundly based. Of course these decisions will need to be effetive so careful judgements will need to be made so that actions solve the quality problem.

I hope that the work you have done was enjoyable and useful enough to encourage you to continue in your studies.

2 Extensions

We recommend that you take up as many of these extensions as you can. They will further increase your understanding and interest. You will also be able to check out a number of the ideas mentioned in our Unit. The extra time and effort will prove very worthwhile.

EXTENSION 1 The Choice Series : 87: Hiring People

Author Richard Holden

Publisher Northern Regional Management Centre

EXTENSION 2 If you are faced with the problem of writing standards for your workteam and have no model to follow in your workplace you may find the following written procedure for using a pool car of interest.

STANDARD OPERATING PROCEDURE

1 Title: Use of Pool Car

2 Purpose: To establish the procedure for use of the pool car.

3 Procedure:

3.1 Anyone wishing to use the pool car for company business should obtain the permission of the Manager responsible for his particular area of work.

3.2 The Manager should ensure the employee concerned has a full and current driving licence.

3.3 All bookings should be made well in advance (whenever possible) through Security.

3.4 Security personnel will keep a register of people using the car showing name of individual; destination; date; time; speedometer mileage reading when vehicle is returned.

3.5 Employees using the car will be told speedometer mileage reading by Security at the time they collect the car keys - they should check this reading before setting out on their journey.

3.6 Employees should tell Security the speedometer reading at the completion of their journey when they return the keys.

3.7 The "incoming" driver is responsible for ensuring that there is at least one quarter of a tank of petrol in the vehicle before returning the car keys to Security.

3.8 i) Drivers must keep all VAT receipts for any expenditure they have to make on the car - this includes petrol, oil and any other incidental expenses.

ii) The expenditure referred to in 3.8 (i) may be claimed back from the company by giving the appropriate receipt(s) to the Administration Manager.

3.9 Drivers are responsible for the cleanliness of the car while it is in their possession - anyone taking over the vehicle in a dirty condition should report this to Security.

3.10 The car is due for service every 6,000 miles - this service will be arranged by the Administration Department who will tell Security the date on which it will be serviced so no booking can be accepted for that day.

3.11 Each driver is responsible for the good running of the pool car - tyres, oil level and water level should be regularly checked and any problems reported to the Administration Manager.

3.12 Insurance details can be obtained from the Administration Department if required.

3.13 In the event of an accident, a Claim Form for Insurance purposes can be obtained from the Administration Department. It is the driver's responsibility to complete this form and liaise directly with the Insurance Department at Head Office (Ext 727) about the claim.

Raised by: JHD

Approved by: DHT

Date: 1.2.86

You may also find it helpful to work through another unit in this series which deals with many of the problems involved in writing instructions for other people.

The Choice Series : 64: Orders and Instructions

Author: Diana Thomas

Publisher: Northern Regional management Centre

EXTENSION 3 The Choice Series : 39: Quality Circles

Author: Ysanne Carlisle

Publisher: Northern Regional Management Centre

EXTENSION 4	The Choice Series:	30: Looking at Figures
	Author:	Linda Carr
	Publisher:	Northern Regional Management Centre
	The Choice Series:	32: Using Graphs
	Author:	Linda Carr
	Publisher:	Northern Regional Management Centre
	The Choice Series:	34: Easy Statistics
	Author:	Ysanne Carlisle
	Publisher:	Northern Regional Management Centre
	The Choice Series:	43: Descriptive Statistics
	Author:	Ysanne Carlisle
	Publisher:	Northern Regional Management Centre
EXTENSION 5	Book:	Using Statistics in Business 1
	Author:	Peter Clark
	Publisher:	Pan
	See Chapter 13.	
EXTENSION 6	Book:	Using Statistics in Business 2
	Author:	Peter Clark
	Publisher:	Pan

These extension opportunities can all be taken up via your Support Centre.

They will either have the materials or will arrange that you have access to the materials. However it may be more convenient to check out the materials with your Personnel or Training people at work - they may well give you access. There are other good reasons for approaching you own people, for example they will become aware of your interest and you can involve them in your development.

3 References

REFERENCE 1 Publication: BS 5750: Quality systems

Publisher: British Standards Institution

These references can all be taken up via your Support Centre. They will either have the materials or will arrange that you have access to the materials. However check with your Personnel or Training people at work - they may well give you access. There are other good reasons for approaching your own people, for example they will become more aware of your interest and you can involve them in your development.

If you do wish to make use of these references then don't think that you must read them right through. Just dip into them for a slightly wider treatment of the topic raised by the unit.

I should warn that the language and style of the writing is often difficult to cope with. So don't struggle with it too much. Do what I do when in difficulty, put the book back on the shelf and find a better one!

THE CHOICE SERIES

PRINCIPLES AND PRACTICE OF SUPERVISION

11 Needs and Rewards
12 Enriching Work
13 Workteams
14 Team Leading
15 Leading Change
16 Organisation Systems
17 Supervising in the System
18 Supervising with Authority
19 Workplace Control
20 Taking Decisions

TECHNICAL ASPECTS OF SUPERVISION

30 Looking at Figures
32 Using Graphs
33 Method Study
34 Easy Statistics
35 Quality Control
37 Controlling Output
38 Value Analysis
39 Quality Circles
40 Computers
41 Stores Control
42 Managing Time
43 Descriptive Statistics
45 Supervisors & Marketing

COMMUNICATION

60 Communicating
61 Speaking Skills
62 Writing Skills
63 Communication Systems
64 Orders and Instructions

ECONOMIC AND FINANCIAL ASPECTS

70 Accounting for Money
71 Control via Budgets
72 Cost Reduction
73 Wage Payment Systems
74 The National Economy

INDUSTRIAL RELATIONS

80 Training Plans
81 Training Sessions
82 Discipline and the Law
84 Health and Safety
85 Industrial Relations in Action
86 Equality at Work
87 Hiring People
88 Supervising and the Law